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NATIONAL SAFETY COUNCIL

IN a recent report from the Office of War Information it was disclosed that more lives have been taken by industrial accidents since Pearl Harbor than the number lost by guns and bombs of the enemy.

According to the best available estimate, accidents have killed 37,600 workers—which is 5,000 more than the losses reported by the armed forces. 4,710,000 additional persons were disabled through accidents or 60 times the number of fighting men wounded or missing in action. These figures are announced in the O.W.I. survey of accidents in war plants. When broken down on the basis of production the loss to industry would amount to 270,000,000 man days or the equivalent of withdrawing 900,000 workers from the production lines for one year.

Although added precaution has been taken by industry to prevent accidents during present high production activity, the O.W.I. emphasizes the necessity for even greater attention to accidents and loss of life that take place in our industrial plants.

"A second front of safety" should be opened up by industries which have not already taken hold of the safety problem. The use of posters, house organs, pamphlets and other publicity tools will help to educate workers and impress them with the rules of safety.

In the metal-finishing industry, certain processes and operations are prevalent which develop special hazards peculiar to this industry alone. For this reason, certain research activities are necessary to discover the destructive possibilities before disaster overtakes the plant and its workers. It is important to take these steps at the beginning of the new operation or use of new material, and not after its use or consumption has been initiated.

This is a problem that requires an intelligent and educational program for the managers of industrial plants—Safety should come First.

Tin Plating

IN pre-war years about 60 per cent of the tin plate output in the United States was used in the food canning industry, while the manufacture of containers for oils, paints, drugs and spices, together with the manufacture of ice-cream cans, dairy cans, pails and equipment, stamped kitchen-ware, bottle caps and similar products consumed about 40 per cent of total production. It has been estimated that about 90 per cent of all tin plate finds its way into containers of some kind or other.

For hundreds of years up until recently, the tin coating was applied to the base steel by passing the steel through a bath of molten tin. This was called the hot-dip process. In recent years, however, it has been augmented by the continuous electrolytic process by which the tin coating is deposited on the base metal by electricity, a process basically the same as nickel or silver plating. The steel, or base metal, comprises about 98.5 per cent or more by weight of the finished tin plate.

The tin on hot-dipped stock forms a coating of only about 0.00008 inch thickness, on electrolytic plate about 0.00003 inch thick. These minute coatings permit proper soldering, reasonable protection against rusting, as well as proper preservation of the sealed food when tin plate is used for this purpose.

In normal times, the United States accounts for approximately 50 per cent or more of world tin plate production. In 1942 domestic tin mill output totaled something like 2,900,-

000 tons. Tin mill output included 86 per cent tin plate, 8 per cent black plate and 6 per cent terne plate.

All three products are manufactured in tin plate mills. The term black plate will be explained presently. Terne plate is steel coated with lead and tin and is widely used for roofing and for gasoline tanks.

Historiette

Tin as a coating agent has a recorded history that extends back to the days when Rome basked in the glory of her power. The Romans coated copper vessels with tin to make them suitable for use as food containers. Pliny has recorded that tin-coated cast or wrought iron utensils were used prior to 23 A.D. There is some evidence to prove that the coating was applied by immersion in a bath of molten tin.

Only a few obscure historical references afford an inkling as to how sheet iron, which was subsequently replaced by steel, first came to be coated with tin. One story has it that a refugee tin miner from Cornwall, England, discovered it in the Bohemian Erzbirge mountain around 1240 A.D. At any rate, it was during the next 200 years that the tin plating of iron sheets by immersion became firmly established in Bohemia. In fact, by 1575 the demand for tin plate had so increased in Bohemia that Cornish tin was imported to augment the local supply. In those days pots, pans and other tin wares represented the principal applications of tin plate.

It is said that in 1620 the Duke of Saxony sent an agent into Bohemia, who learned how to make tin plate. By 1665 Dresden had become quite noted as a city in which tin plate was manufactured.

The manufacturing of tin plate was introduced into England about 1665.

A U. S. Navy commisary and its ubiquitous tin cans. Cans for food represent the largest single application for tin plate.

Mirrored in a stack of tin plate, this worker examines a plate for surface defects.

That the industry did not get under way immediately would be indicated by a report which states that in 1697 there were no iron mills in England which possessed facilities for making tin plate.

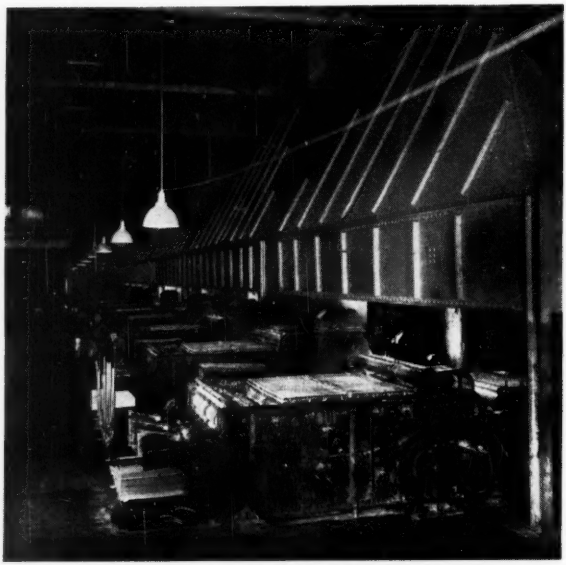
Development

The industry got a firm foothold in England, however, in 1720 when Major Hanbury opened a tin plate mill at Pontypool. In Hanbury's plant the base metal was wrought iron. The year 1728 marked an important milestone in the history of sheet metal which had a bearing on tin plate manufacture. The method of rolling iron into sheets was used by Hanbury and his partner, Payne. Previously, plates and sheets were hammered into shape.

In 1770 the steam engine was introduced into rolling mills and further increased efficiency. About this period coke came into use to augment charcoal to refine iron ore. This resulted in two grades of tin plate, coke and charcoal, the latter being considered superior. These two terms, coke and charcoal plate, are still used in the trade—to designate in a general

way the amount of tin coating a plate carries.

Up until 1806 the base plates were pickled prior to tinning by placing them in fermented barley water. In that year sulfuric acid came into use as the pickling agent. Still another development was an invention by Morewood in 1863 for carrying the sheets out of the tin bath through rolls, which insured more even distribution of the tin on the base surface.



Tin house where sheets of black plate receive a coating of protective tin. The hot dip process, sketched in the large diagram on page 26 is employed.

By this time the South Wales district, with its natural deposits of tin and iron, had gradually become the world's tin plate manufacturing center, a position it maintained until late in the nineteenth century, when the United States decided to do something about making its own tin plate.

United States

In about 1874 the first attempt was made to manufacture tin plate within our borders. Sheet iron was used. Plants were erected at Demmler, Pa., by the United States Iron and Tin Plate Co., at Wellsville, Ohio, by the American Tin Plate Co., and at Leechburg, Pa., by Rogers and Burchfield. But the formidable competition offered by South Wales plate proved too much, and about four or five years later these plants turned to manufacturing light sheets for enamel ware instead of tin plate. There was no protective tariff on tin plate at the time.

In 1890 total production in South Wales was about 650,000 tons, of which fully 70 per cent was shipped to us.

In 1891 the McKinley Tariff Act was passed by Congress, imposing a duty of 22 cents per pound on tin plate imports. With production only 11,189 tons that year, the United States quickly stepped up output and soon was leading all countries in production.

Black Plate

With the development of the tin plating process itself comes the development of a suitable base metal. In about 1890 steel replaced iron in this respect.

The bare, uncoated steel is known as black plate and is sold under a number of trade names. Aside from being black in color, its surface is hard, smooth and clean — to insure proper adhesion of the tin. Black plate has a number of other applications, among which are containers for dry and non-corrosive materials, signs,

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An example is this A-F Equipment for high-speed cleaning, rinsing and drying miscellaneous airplane castings. With 36 in. wire mesh conveyor, this A-F Equipment cleans and dries all types of castings up to 17 x 36 inches in size.

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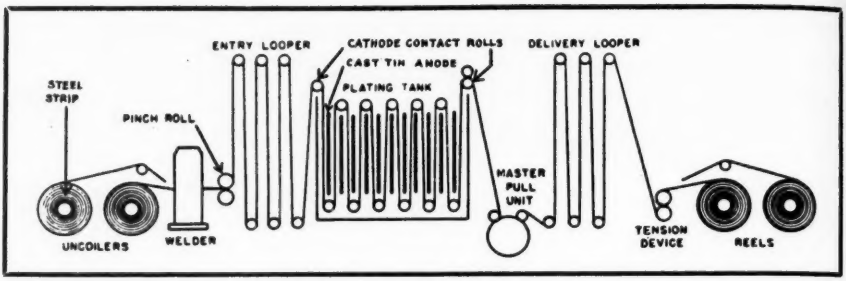


Diagram of one form of electrolytic tin plating line. The strip coils may contain three miles of 36-inch strip steel. The thickness ranges from 0.005 to 0.015. One 5½-foot diameter coil may weigh as much as 15 tons.

counter displays and others.

Black plate may seem simple to prepare, but it isn't. It undergoes a number of operations before it is ready to receive its coat of tin. First, strip previously hot-rolled to a thickness of about 0.072 inch is pickled to remove scale and dirt; then cold-rolled to the desired thickness, ranging from 0.009 to 0.012 inch. After the plate is cleaned, it is cut into sheets, annealed, and tempered by passing through another set of cold rolls. The final thickness of the black plate is usually 0.01 inch, or 31 gauge.

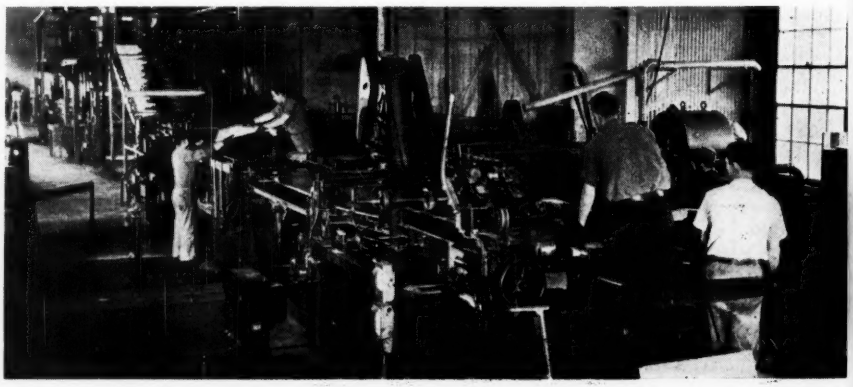
Hot-Dipped

In the hot-dip method tinning consists essentially of passing the prepared black plate through a bath of molten tin. Tin, which has a melting point of 450 degrees F., adheres to the surface as a thin layer of iron-tin alloy forms at the junction and serves as a bond. A diagram of a modern tin pot, or tinning machine, which may contain from 2.5 to 5 tons of molten tin, appears on the next page.

Carried downward by the conveyor mechanism, the plates first go through a layer of zinc chloride flux floating on out through a bath of palm oil. The oil prevents oxidation of the hot tin. Cast iron rolls strip off excess tin and distribute the remainder evenly over the surface.

Several rolls made of flannel disks

Trimming end of an electrotinning process in which the tin coating is deposited on black plate.



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remove most of the palm oil and polish the sheets. The sheets then pass under a stream of finely-ground wheat middlings or peanut shells which absorb any remaining palm oil and impart further polish. The sheets are now ready for grading and packing for shipment — in the form of base boxes.

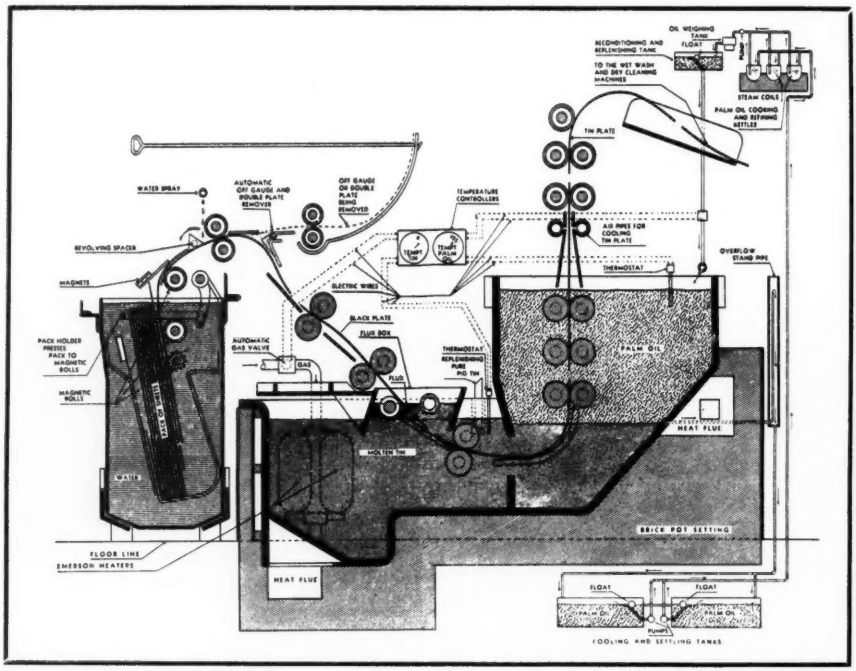
A base box, containing 112 sheets each 14 x 20 inches (62,720 square inches to be coated) of 0.01 thickness, and weighing about 97 pounds, is the standard unit of quantity per base box. Thus, a base box of hot-dipped plate may carry 1.5 pounds of tin; a base box of electrotinned plate 0.5 pound.

Electrotinning

The first application of electrotinning was not to make tin plate, but to coat such articles as buckles, brackets and lamp fittings. This began about 1850 when an alkaline tinning bath, consisting of a solution of stannous chloride and sodium pyrophosphate, was first used successfully as the electrolyte. Then came solutions of stannous chloride and potassium hydroxide.

Acid electrolytes were the next important development in electrotinning. These came into use during World War I when a demand arose for electrolytic tin and a successful acid process was developed and improved upon several times. In 1923, when the industrial production of electrolytic tin came to a halt, the solution consisted of tin, sulfuric acid and cresol sulfonic acid, with additions of glue and cresol.

From black plate to tin plate by the hot dip process.



About 15 years ago methods were introduced to tin plate continuous steel strip electrolytically. J. S. Nachtman is one of the pioneers in this field. In 1927 he supervised what was perhaps the first installation for electrogalvanizing wide strip. This was followed by experimental installations to plate strip with copper, tin and other metals.

Basically the process consists of passing steel strip through an electrolyte of tin salts. The moving strip is supported by rolls around which the plate is looped. The anodes in the form of tin blocks or strips, are placed in the valley of the loops. Current passes from the anodes through the electrolyte to the strip, which acts as the cathode upon which the tin is deposited. The accompanying diagram shows details of a modern installation.

Electrolytic Lines

Today every major tin plate producer in the United States has either completed or has underway construction of continuous electroplating installations.

Prominent organizations either actively producing or with plants in construction are: Carnegie Illinois Steel Corp., Gary, Ind.; Bethlehem Steel Co., Sparrows Point, Md.; Crown Cork and Seal Co., Baltimore, Md.; Jones & Laughlin Steel Company, Pittsburgh, Pa.; Granite City Steel Co., Granite City, Ill.; Inland Steel Co., Chicago, Ill.; Republic Steel Corp., Warren, Ohio; Weirton Steel Co., Weirton W. Va.; Wheeling Steel Corp., Wheeling, W. Va., and Youngstown Sheet & Tube Co, Youngstown, Ohio. All in all, about 26 new plants were scheduled to start production last year. Incidentally, the Crown Cork and Seal Company is said to be the only organization in the tin plate field which consumes as well as manufactures the product.

Estimates place the present total annual capacity of the continuous electrolytic lines at about 40,000 base boxes, the plating of which would require about 10,000 tons of pig tin. To plate that quantity by the hot-dip method about 23,000 tons of pig tin would be required.

There are other advantages of electrolytic tinning. First, it is possible to tin wide strip, up to about 36 inches at present, on a continuous basis. Continuous hot-dipping of strip steel has not been found practical with the exception of relatively narrow strip. Secondly, electrolytic tinning permits very thin coatings to be applied to obtain perfect coverage of the base metal. In the hot-dip method it is difficult to obtain perfect coatings less than 0.00008 inch thick. Lastly, the electrolytic process makes for greater uniformity of the coating.

Technically Speaking

A wide variation prevails in the methods and equipment used to produce electrolytic tin plate, although, broadly speaking, each installation comprises a pickling unit, the plating and brightening lines.

Most of the plants employ some variation of the sulfuric acid bath, or an acid bath supplemented by electrolytic action, to pickle the steel strip on a continuous scale.

There appears to be no clear-cut choice as to the relative efficiency of the acid and the alkaline tinning bath in the industry today. One authority states that a distinct advantage of the alkaline bath is that it produces a better quality of tin coating than the acid. He is quick to add, however, that the acid bath deposits about 2.5 times more tin per ampere hour.

In general, the strip steel is passed through tanks containing either an acid or alkaline electrolyte in which tin block or strips act as anodes. One typical installation is a four-pass vertical plater, each pass 5 feeet deep. The plating bath is a phenol sulfonic

acid solution. Tin anodes are suspended into the mouth of each U-shaped pass. Speed of the strip through the plater is about 350 feet per minute.

Another interesting installation is one in which some variation or modification of the alkali electrolyte is used. In this alkaline plater, the strip is given 16 vertical passes, each pass 12 feet deep. Tin anodes about 7 feet long and weighing around 2,300 pounds are suspended into the opening of each pass.

Finishing

The plate is produced with a dull satin finish, after which the tin coating is polished either mechanically by brushing or reflowed by an electric fusion method. This brings the tin on the steel to its melting point and produces a smooth bright finish. It then is quickly quenched in water which solidifies the coating.

Petroleum

Mills which roll black plate are able to produce at high speeds because highly specialized petroleum oils and greases are used for bearings and gears. No more severe lubrication problems exist than in these and other steel plants. In the tin plate mills, however, there is an added problem which recently has been solved by the petroleum industry. The rolls of the cold mill stands have been traditionally lubricated with palm oil, but today palm oil is difficult to obtain. The petroleum industry went to the aid of cold rolling mills by supplying palm oil replacements which are giving satisfactory service.

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Multipore

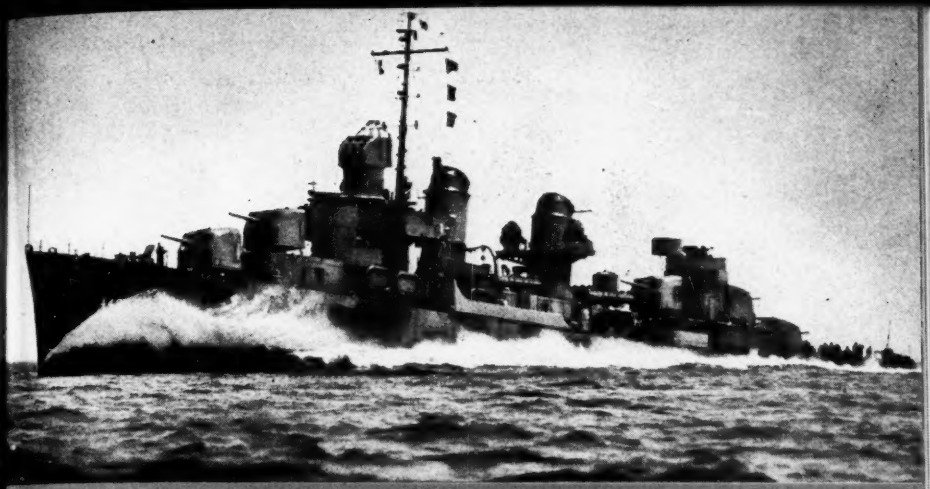
UNITED STATES RUBBER COMPANY, Rockefeller Center, New York, N. Y., has announced the development of "Multipore," a filter material containing as many as 6400 perforations to the square inch, which is now being used by chemical plants, food factories, medical manufacturers, coal and iron mines, steel mills and many other types of industry.

Multipore may be traced back to the day 18 years ago when chemists at the laboratories were pioneering in the use of natural rubber latex for waterproofing raincoat fabric. Pinholes almost microscopic in size mysteriously appeared after the fabric had been heated in the drier. These holes were found to be the result of small explosions. Pockets of air were being trapped within the mesh of the fabric. When they were expanded by heat they exploded through the film of latex spread on the fabric.

A remedy to eliminate this defect was found. Scientists reversed their findings to see just how many holes they could create in a square inch of latex film. After intensive research, they succeeded in blowing as many as 6,400 holes to the square inch, in sheets up to 42 inches wide and 20 yards long.

These filter screens are made of either hard or soft rubber, and may be compounded to resist abrasion, high temperatures, alkaline and acid solutions, as well as certain oils and greases. Being made from natural rubber latex of the Hevea tree, now one of the most critical of all materials, the filter can be applied only to the most important products.

One important use of Multipore is in silver plating the bearings of airplane engines. This, a new method, is said to reduce plating time from six hours to one and a half hours. In addition to speeding output, the new technique employing anode holders of multipore creates a silver plate of maximum uniformity, wearing qualities, and smoothness.



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How fine these ships are is well expressed in the following extract from a letter written by the commanding officer of the destroyer pictured above:

"A word of praise for the grand job the Bath Iron Works did on the ship. She has been through h—l and high water and never failed us. Keep on building ships as fine as this . . . We have put on nearly one hundred and fifty thousand miles and she is as good as new."

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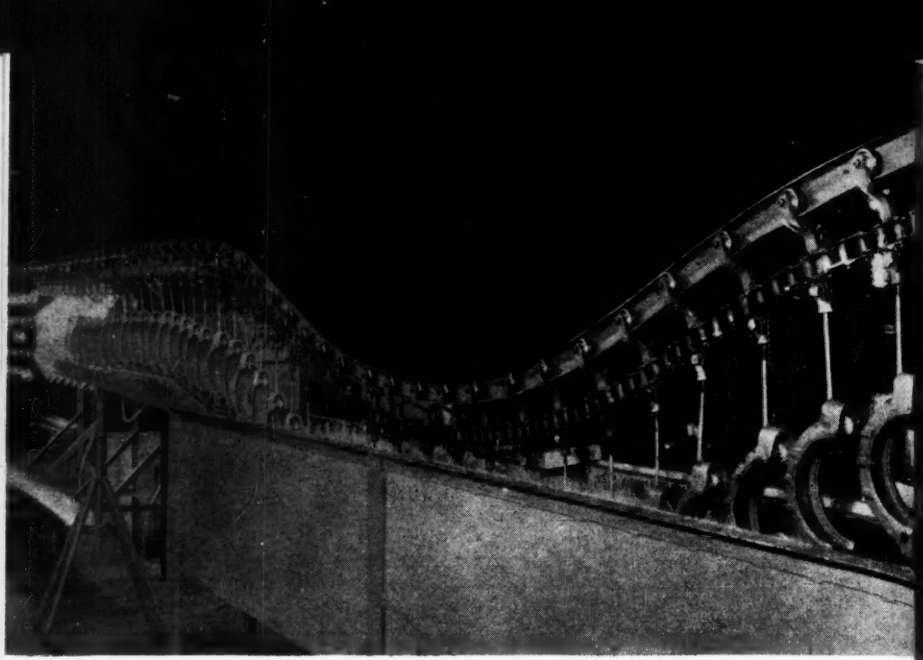


Coupling the Army's Portable Pipeline

By GORDON H. ROBERTSON
Industrial Finishes Division
The Sherwin-Williams Company, Cleveland, Ohio

Much has been written about the Big Inch pipeline built in this country to expedite war fuel transportation, but here is data on the Army's "front-line" portable pipeline which is used in the field.

IF there is any one vital commodity that a modern army cannot do without for long, it is gasoline and oil. Moreover, it is equally important that it be available when and where it is needed in sufficient amounts. All of which means that sooner or later there had to be developed a faster, better method of transporting oil products. That method is today known as the "front-line" pipeline, invented by a Shell Oil Company technician long before Pearl Harbor and tested on the Burma Road before it fell to the Japs.

Briefly, a portable pipeline is made up of 20-foot sections of 4-inch flexible light steel pipe with pumping sta-

tions at 10-mile intervals. All the equipment is transported on trucks or trailers. In the field, the pipeline requires no trenches, since it follows the contour of the terrain. In tests it has been wrapped around trees, bent over hills and curved across streams without a decrease in its efficiency.

Back in Service Fast!

Perhaps the outstanding advantage of the "front-line" pipeline is the speed with which it can be restored to normal service after damage by the enemy. Pumping stations are operated by gasoline-fuel engines. If put out of action, a station can be repaired in a few hours. Meanwhile, the system's capacity is reduced only 30 per cent. In fact, two adjacent pumps can be damaged and the system will continue to operate.

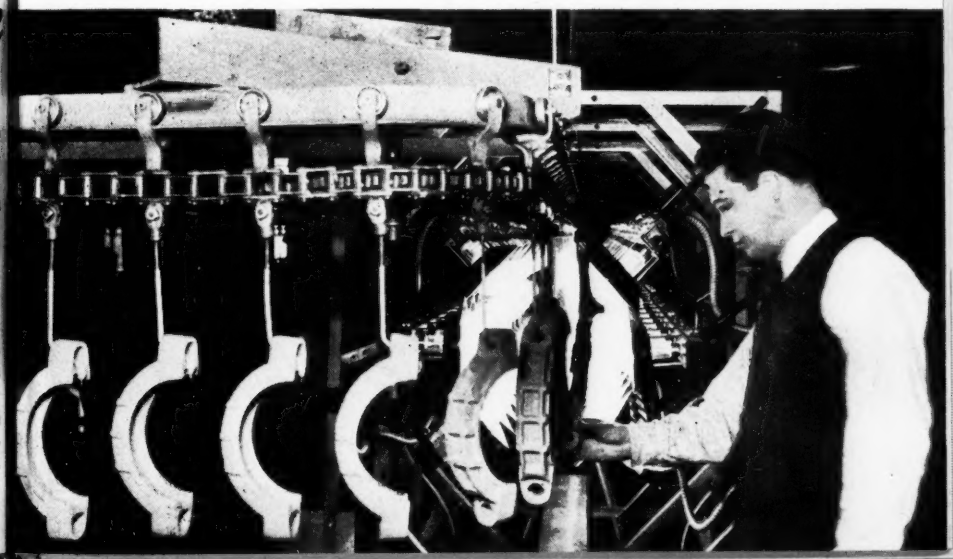
The pipe itself is a poor target for enemy bombs. However, once a break does occur, repair crews quickly locate it, shut down the valves and swing in a replacement piece of pipe, all within one to four hours!

The speed and skill with which these repairs are made may be further appreciated when it is remembered that the length of the front-line pipeline ranges between 75 and 300 miles! In fact, once the break is located, the patrol crew finds it a comparatively simple matter to "loop" in an undamaged section of pipe. This is due in large measure to a simplified yet effective coupling designed for use on grooved-end pipe. The coupling is composed of only a two-piece housing, two bolts and nuts, and a synthetic gasket, and assures a tight seal even during the movement of the pipe ends. One type, produced by the Gustin-Bacon Manufacturing Co., allows a deflection of three degrees. No special tools are required to fit the coupling—an ordinary open end or socket wrench suffices.

Protection Against Corrosion Important

Inasmuch as the front-line pipeline is constantly being extended, shortened and replaced, it is particularly important that the couplings be easily and quickly removed and just as quickly replaced. Continuous expos-

Fig. 2—The surfaces of the couplings finished hard and tough, they emerge from the infra-red ovens. After a three-to-four minute cooling period they are ready for packing and shipping.

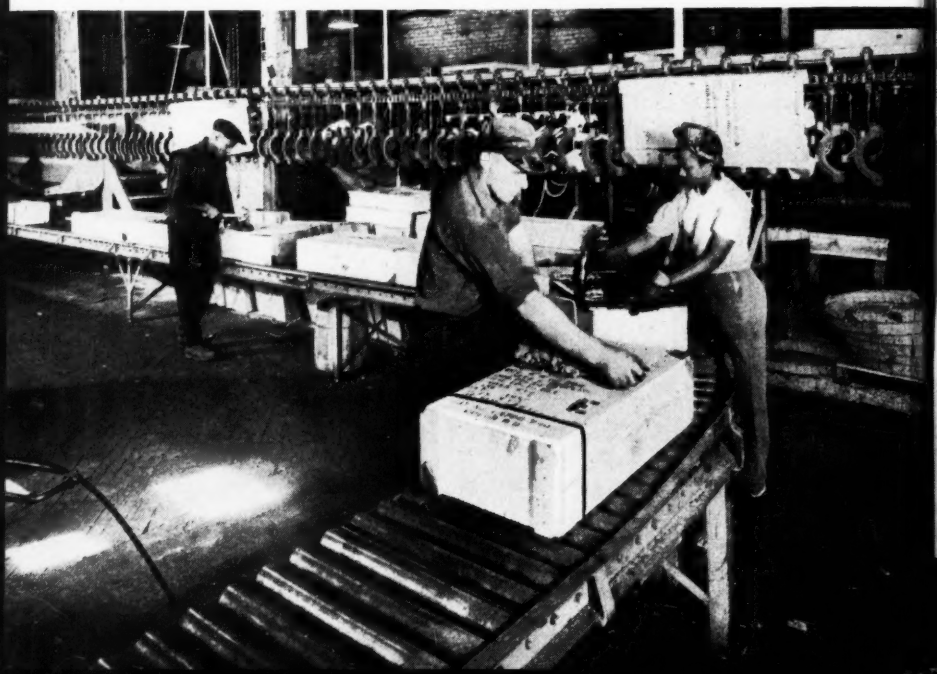


ure to the elements and contact with soil subject the coupling to many corrosive influences that might impair its operating efficiency. Consequently, it is essential that the couplings be finished so as to prevent rust and scale formation. In the finishing room of the Lake City Malleable Co., one of the larger producers of the coupling, it is the practice to finish each coupling with a coat of Sherwin-Williams infra-red reflectant, olive drab paint. Because of the high output of the foundry, the finishing room would find it extremely difficult to maintain a fast pace were it not for the extremely efficient finishing production line.

After each casting has been dressed down, it is suspended on a hook from a monorail conveyor. It then travels to a tank containing the olive drab paint, where it dips down for a quick immersion as shown in Fig. 1. As the couplings come out of the paint tank and move along the conveyor, a guide tilts them to allow surplus paint to drip off. When the couplings pass this guide, they straighten out and enter the first of two infra-red ovens.

The problem of how to synchronize finishing with production involved very intimately the rate of speed with which the finished couplings dried. This, in turn, depended upon the formulation and drying qualities of the finish employed. Sherwin-Williams technicians in conjunction with the U. S. Corps of Engineers developed an infra-red reflectant, olive drab paint with an unusually high drying speed. When the coupling enters the first infra-red oven, the volatile constituents of the paint are flashed off. The finish then dries to a hard, tough surface in the second infra-red oven. The couplings then continue to move along the conveyor to a point where

Fig. 3—No time is lost between finishing the couplings and preparing them for shipment. On a highly mechanized shipping "assembly line," couplings are boxed, identified and secured with steel strapping. The roller conveyor in the foreground leads to the shipping platform.



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they cool for about three or four minutes and can then be handled without gloves. The infra-red ovens are manufactured by the Fostoria Pressed Steel Corporation and consist of 96 gold-plated reflectors mounted in three rows on each side. The upper two rows of reflectors are equipped with 250-watt infra-red lamps; the lowest row is equipped with 375-watt lamps. In Figure 2 the couplings may be seen emerging from the infra-red ovens, with the surfaces finished hard and tough. After a three-to-four minute cooling period they are ready for packing and shipping.

No time is lost between finishing the couplings and preparing them for shipment. Figure 3 is a view of a highly mechanized shipping "assembly line" on which the couplings are boxed, identified and secured with steel strapping. The roller conveyor in the foreground leads to the shipping platform.

As the Allied armies project themselves further and further into the European fortress and the speed of pincer movements is accelerated, the amount of pipe needed to keep fuel, lubricating oil and water moving up to advance motorized units is rapidly increasing. To keep up with the demand, the A-P Parts Company, Toledo, Ohio, piping subcontractors, have devised an automatic paint spraying unit for coating the spiral-welded piping in conjunction with a forced drying system. According to recent reports, sufficient quantities of piping were coming off the production line to more than satisfy the demand of the armed forces for this latest development in the transportation of war fuel.

(Illustrations courtesy The Sherwin-Williams Company)

Sawdust to the Rescue

SAWDUST as a cleaning compound for removing dirt and oil from aircraft parts after magnetic inspection, and prior to organic or inorganic treatment, is saving salvage, skin, many hours, and critical materials at Interstate Aircraft plants.

The sawdust method, as developed by Paul Lamb and Hoarce Maxfield of the Los Angeles plant, is inexpensive and easy to install and operate. By tumbling or rolling the part in a dry sawdust bath, the excess dirt and oil from all magnafluxed parts is removed. The sawdust adhering to the parts is blown off easily by a sharp blast from an air hose, leaving a thin film of oil to protect the part from corrosion.

The action of the sawdust in soaking up the excess oil and dirt left by the magnafluxing minimizes the amount of cleaning required. With this method, a resultant thin film of oil is left on the part which protects it until final plating or painting. This is vitally important, since any lengthy delay between cleaning and the coating process allows corrosion to set in. One important advantage cited for the method is the insurance of a reserve supply of corrosive-resistant parts when storage is necessary before assembly.

Instruments Bulletin. Superior Instruments Co., 227 Fulton St., New York 7, N. Y., has issued Bulletin No. 102 covering the Model 700 Volt-Ohm-Milliameter, the Model 560 Industrial Analyzer for measuring volts, ohms and amperes, and the Model 610-B Meg-O-Meter, a battery-operated insulation tester. Copy of this illustrated folder free upon request.

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Methods of Evaluating Metal Finishes

By JEFFREY R. STEWART

During wartime, methods of evaluating protective coatings for metals are changed or improved so rapidly that magazine articles must supplement previously printed texts. The author provides up-to-date information on several important tests.

Methods of Measuring Infra-Red Reflectance

BEFORE Pearl Harbor there was very little discussion regarding methods of measuring infra-red reflectance values of military paints, with the exception of some scattered information in the press of foreign nations. Now, however, considerable emphasis is being placed on this subject. This is probably due to the fact that the Ordnance Department of the U. S. Army has incorporated the infra-red reflectance test into their paint specifications.

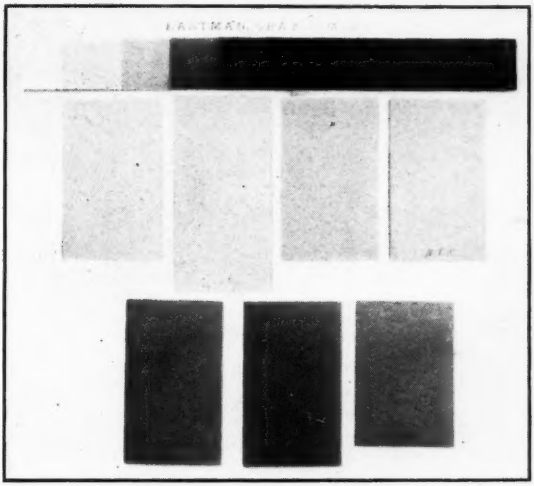
Originally, infra-red (and other long wave) aerial photography was used for penetration of ground haze. Today, however, infra-red photography is used at least as much for detection of artificial structures as it is for penetration of ground haze and mist. Infra-red photography lends itself to this function because chlorophyll[1] possesses the unusual property of reflecting infra-red light to a considerable extent. Most dark paints and building materials used in warfare reflect very little infra-red light and, therefore, are easily detectable against a natural chlorophyll background by means of infra-red photography. The object of using infra-red reflecting paints is to provide a concealment for man-made structures and munitions, which will serve not only as a visual camouflage, but will also have appreciably the same infra-red reflectance as chlorophyll. Thus it is obvious why the Army has included this test in its specifications for munition paints.

Overcoming the Difficulties

In making this test, it will be found that a number of difficulties appear when attempts are made to realize this aim. Beck[2], an authority on this subject, has done much to solve some of the problems. He prepared the U. S. Army Specification No. 100.12 in cooperation with specification writers and material engineers of the War Department. Readers of this article who are interested in the details of this test should write direct to the

[1]Chlorophyll has previously been defined in PRODUCTS FINISHING as the green coloring matter which gives the characteristic color to plants.

[2]S. E. Beck, Chief Chemist of Camp Holabird, Ordnance Department, U. S. Army, Baltimore, Maryland.



Photograph showing infra-red reflectance values of some typical munition paints. This photograph was taken with the 89-A Wratten filter, and with careful attention to the specifications and directions in U. S. Army Specification No. 100-12.

War Department, Pentagon Building, Washington, D. C., for a copy of the specification which, incidentally, is free of charge.

Several infra-red filters can be used in aerial photography and the performance of different pigment combinations as compared to chlorophyll varies with each filter. According to Beck, if a pigment combination could be found whose spectrophotometric curve was identical with that of chlorophyll, paints made with this pigment would be indistinguishable by the enemy from chlorophyll by any of the colorimetric means of measurement. Such a pigment is, unfortunately, only a hoped-for possibility at this time. All of the pigments which we now use in our paints are different from chlorophyll in at least some part of the spectrophometric curve. Therefore, they can be detected by the use of the proper filter-film or photocell combination.

The two filters most commonly used for infra-red measurements are the Wratten 89-A and the Wratten 87. The 89-A is a wider-range filter than the 87 and transmits light from 6800 A°. The 87 filter does not transmit light until 7400 A°. Since shorter wave lengths are more energetic, the light transmitted by the 89-A filter will develop a photographic plate with a shorter exposure time than will that transmitted by the 87. Consequently, the 89-A filter is more widely used for aerial photography and is the filter usually selected for specification requirements — especially insofar as the U. S. Army is concerned.

Laboratory Measurements of Infra-Red Reflectance

The three standard means for measuring infra-red reflectance in the laboratory are:

1. Spectrophotometric method.
2. Photographic method.
3. Reflectrometric method.

The spectrophotometric procedure is, by far, the most accurate of the three. No filter is needed and the results can be computed for any filter-photocell or film combination desired. However the instrument is not only difficult to operate but also is very expensive. For the ordinary testing laboratory with a limited budget, this instrument need not be considered.

The photographic method[3] is somewhat more accurate than the reflectrometric because it corresponds closely to the procedure used by air-

[3]Laboratories that want to employ this method may obtain a set of the reflectance standards which conform to the specifications of the Ordnance Department. A limited number are available, free of charge, to readers of PRODUCTS FINISHING. With each set of standards is included the procedure to be followed in making the test.

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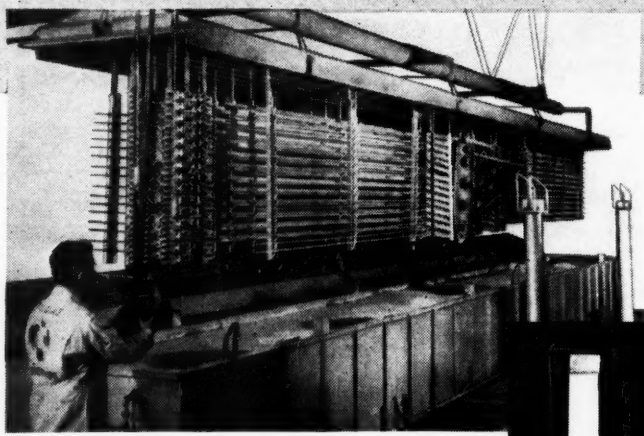

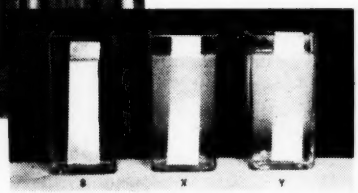

Triad Aluminum Cleaner (indicated in photo below as Cleaner B) is a highly buffered material which prevents attack on the softer metals, especially aluminum. Note rapid attack of materials X and Y on polished aluminum strips at normal operation concentration.

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craft in actual reconnaissance. However, results of a numerical nature are not generally obtained by the photographic method unless a densitometer is employed.

Reflectrometric measurements are simple and rapid. They are also sufficiently accurate for control purposes. However, when an accuracy of greater than plus or minus two per cent is required, the reflectrometric method is not suitable. (Further information regarding this important test can be obtained by writing to the author of this article, who will be glad to answer any questions.)

Measuring the Gloss of Camouflage Finishes

Most of us realize that camouflage paints used on munitions have little or no gloss. There are already about 10 different instruments or methods for measuring gloss. Furthermore, there are new methods and instruments now in the development stage. It is important, therefore, that we consider the most desirable of the various methods. Out of the many types of methods and glossmeters, there are two which seem to be the best. The first is the Hunter Photoelectric Glossmeter. However, due to the wartime shortage of certain parts used in this instrument, production is temporarily being delayed, and a new type of instrument is being designed to take its place. It is expected that the new model will be available some time during the spring of 1944. In the mean time, another method can be substituted which is recommended by the Bureau of Standards of Washington, D. C. This method incorporates the use of the NBS Low-Gloss Standards.

The Bureau of Standards issues low-gloss standards for use by manufacturers and representatives of the armed forces in testing the compliance of camouflage paints where specifications require a low gloss. Frequently in the examination of these materials, measurements of identical materials or paints, in different laboratories but on supposedly identical apparatus, have yielded results in serious disagreement. The purpose of the low-gloss standards, therefore, is to help eliminate the disagreement in measurements of 60-degree specular gloss of camouflage materials and paints.

The standards are calibrated on the scale defined by Procedure A of the American Society for Testing Materials, tentative method No. D-523-41-T for the specular gloss of paint finishes. Values for the specular gloss of the standards before correction for diffuse reflection are given. The standards are issued in sets, each consisting of the following: (1) two ground gray-glass plaques having a gloss about six; (2) 20 sheets of resin-impregnated sandpaper having a gloss about two; (3) 20 sheets of white coated paper having a gloss about five; (4) 20 sheets of white coated paper having a gloss about 13, and (5) 20 sheets of coated paper having a gloss of about 20.

Each of the sets is supplied with a report giving the gloss of the glass panels at the time of issue, and the estimated permanence of the gloss of the different panels. The bureau sells the sets of standards, each containing 82 pieces, at a price of $20. Readers who are interested in obtaining further details may write to the National Bureau of Standards, Washington, D. C., mentioning the NBS test fee schedule No. 4315-Z.

Measuring Toughness of Varnishes

The use of varnishes in the metal-finishing industry is of sufficient importance to warrant some study. Recently some improvements have been made in the "kauri reduction test," which is not only used to predict the durability of the varnish, but also serves as a measure of the toughness. Most paint technologists are already familiar with this test, but few, if any,

know of a big improvement which will soon be published by the Bureau of Standards.

The main difficulty in the kauri reduction test was the fact that erratic results were obtained by using the conventional non-volatile determination method. If a solution of run kauri gum is made up in turpentine with the specified distillation range on the theoretical basis of 33.33 per cent non-volatile content, the actual laboratory results would indicate readings of from four to five per cent higher than expected. This has been the cause of considerable controversy and unjustified rejection of a considerable gallonage of various varnishes.

Several laboratories have attempted to solve this problem in cooperation with the Bureau of Standards and several large manufacturers of paints and varnish. It was found that the discrepancy was caused by the fact that a certain amount of the turpentine became "trapped" during the evaporation period in the oven. This accounted for the fact that the results were four to five per cent higher than would be expected, but did not solve the problem as to how a chemist could obtain reasonable results, insofar as the non-volatile determinations were concerned.

Several ideas were suggested by various laboratories to eliminate the difficulty. It was finally decided that the best method was the use of a small amount of castor oil in the determination. The object in using castor oil was to prevent the solution from drying hard in the oven, thus facilitating the complete evaporation of the turpentine. This recommendation proved to be the solution to the problem, and the procedure that is suggested in future non-volatile determinations on run kauri turpentine solution is given in the following portion of the article.

Correct Method of Standardizing Run Kauri Turpentine Solution

Transfer 10 to 15 ml. of the filtered[4] run kauri solution to a stoppered flask or weighing pipette and determine the non-volatile content in the usual way with the following modifications. Add approximately two grams of raw castor oil, accurately weighed, to each of the 8 cm. dishes or pans before adding the kauri solution. Then heat in an oven for three hours at 115 deg. C., plus or minus 2 deg. C. At least three determinations should be made using samples of kauri solution weighing 1.2 grams, plus or minus 0.1 gram. Also, at least two blanks should be run on the castor oil[5] alone under the same conditions to determine its loss

[4]On samples tested by the writer there was no appreciable loss of volatile matter, so that nearly all samples will show a non-volatile content of 100.0 per cent. The test, however, should be made to make sure no volatile matter is present, or to allow for its presence in the calculations.

[5]In the absence of a means for filtering, the material may be allowed to stand undisturbed for 96 hours and the clear liquid decanted.

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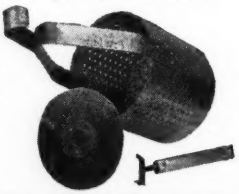
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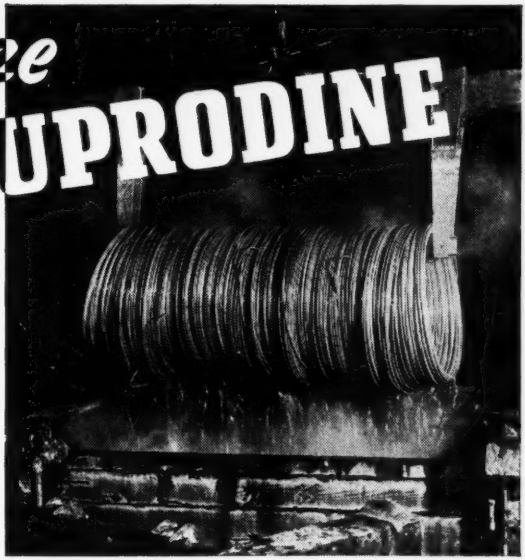

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in weight.

Calculate the kauri solution non-volatile content, making allowances for the loss in weight (if any) of the raw castor oil. From the average non-volatile content thus determined and the weight of the kauri solution, compute the amount of freshly distilled turpentine (gum spirits) required to adjust the non-volatile content of the kauri solution to 33.3 per cent by weight. After the addition of the required amount of the turpentine, it is a good idea to repeat the non-volatile determinations, if time will allow. Results should be 33.3 per cent, plus or minus 0.1 per cent, before the material is used further in the kauri reduction test.

Even at this early date, it has been found that one laboratory can duplicate another's results if this modification is made. Thus a lot of confusion and controversy has been eliminated by the improvement of the test which merely calls for the addition of raw castor oil in the determination.

Porcelain Enamel Industry Studies New Processes

DI-ELECTRIC heating and induction heating for drying and fusing porcelain enamels are two suggested changes in porcelain enamel processing. These methods of heating may have revolutionary effects upon the application of porcelain finishes. Although such work has not been done previously, the importance in other fields indicates that such methods may be possible.

The use of multiple or repeat tanks in cleaning operations and electrolytic cleaning has been suggested. The technicians in this industry agree that better cleaning is important and point to the results which have been obtained for other coating processes, such as plating. The possibility of producing perfectly clean working surfaces on iron or steel sheets has been a matter of long development in the porcelain enamel industry.

Atmospheric control of furnaces is progressing with great rapidity, especially when the protective nature of the porcelain enamel coating is important. The manufacture of water tanks and other containers has been the proving ground for this important method of application. The surface produced seems to be completely free of the usual irregularities.

Air cleaning both as a matter of process control and for the recovery of materials is receiving increasing attention. The proper preparation of air for spraying improves the applicating of the coating. In the recovery of materials from spray booth exhausts some processes reclaim almost 100 per cent of the losses.

Electrolytic precipitation of porcelain enamels in spraying according to many engineers, will result in large reduction in materials used. It will also make application much more complete and uniform, and tend to reduce the loss resulting from irregular or thick coatings. This process, already in use in other industries, is receiving extensive engineering study in the porcelain enamel industry.

The importance of research work in these fields has led the Porcelain Enamel Institute to establish a committee on process development to study new manufacturing methods and report on their adaptability to this industry.

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The Chemistry of Electroplating

By Dr. C. B. F. Young, Consultant

Part 6

IN the previous installment acids, bases, salts, molecular weights, sulfur and sulfur compounds were studied. The importance of neutralization was stressed and the inverse proportion was introduced.

In the present writing the subject of true solutions and their properties are discussed. In the latter portion suspensions, emulsions, colloidal solutions, and the determination of atomic weights are discussed.

In order to produce a solution it is necessary to have two parts which are united or mixed together. Thus sodium chloride or sugar can be dissolved in water to form a solution. In this case the water is called the solvent (the material which does the dissolving), while the salt is called the solute. It will be noted in this connection that when a true solution results there is no settling of material. If sodium chloride is dissolved in water and placed in a vessel which is closed to the atmosphere so that water cannot evaporate, no sodium chloride will settle to the bottom. It is a perfect mixture, or it may be said that the solution is homogeneous. If the sodium chloride solution be passed through a filter none of the salt will be filtered out.

When a solid and a liquid are so intimately mixed that particles of the solid cannot be seen, even with a microscope, it is called a solution. It may be pointed out in this connection that two liquids can form a solution as well as a liquid and a gas. If the mixture resulting has particles which can be seen with a microscope, it is not a true solution but a suspension. If two solutions do not mix intimately, but minute droplets of one liquid are suspended in the other the mixture is called an emulsion. Milk is a good example of this. While solutions do not settle out, suspensions or emulsions are not homogeneous and will settle out with time.

A solvent has been defined as the material which dissolves the solute. Water is a very good example. Many compounds will dissolve in water, forming a solution. Most of our acids, bases, and salts are soluble in water. Organic solutions are also good solvents. Thus, carbon tetra chloride is a good solvent for organic compounds such as grease. The electroplater is primarily interested in water as a solvent and the metallic salts such as nickel, copper, and zinc as solutes. Water is a very good solvent for forming this type of solution. However, in the case of degreasing with trichlorethylene, which is so important at the present time, the electroplater makes use of the fact that this organic com-

pound will dissolve oils and greases present on the metallic surfaces.

The solvent and the solute have been defined earlier in the chapter. The amount of solute which is dissolved in the solvent is known as the concentration of the solution. If there are 100 grams sodium chloride per liter, of course the concentration is 100 grams per liter sodium chloride. When large amounts of solute are dissolved in the solvent, concentrated solutions result. Thus, silver nitrate is a very soluble material in water and a concentrated solution can be made by dissolving large amounts of the solid in water. Silver nitrate in the amount of 213 grams will dissolve in 100 grams of water. A dilute solution is one in which a small amount of the solute is present in the solvent. Dilute solutions can be made concentrated by boiling off the water leaving behind the solute. If the boiling is continued the solution can be evaporated to dryness. In this case all the water is being boiled off, leaving behind all the solids as the dry material.

A saturated solution is obtained when the maximum amount of solute is dissolved in the solvent and an excess of solid is in contact with the resulting solution. An example might make this clear. Taking, for example, silver nitrate, at 18 degrees C. it is possible to dissolve 213.4 grams of this salt in 100 grams of water. It is possible by other means to dissolve more silver nitrate in water, but this results in an unstable solution known as super-saturated solution. However, a super-saturated solution, being unstable, will not remain as such if some crystals of silver nitrate are placed in the bottom of the container. The super-saturated solution will crystallize, throwing any excess solute out of solution and the resulting product will be a saturated solution. Thus, one can see that a saturated solution will hold the maximum amount of solute in the solvent while the solution is in contact with the solute in the crystal form. It is impossible to produce a super-saturated solution, provided crystals of the solute are in contact with the liquid.

As a general rule, all solids are more soluble with an increase of temperature; however, there are some exceptions. Potassium nitrate is about seven times more soluble at 70 degrees than at 80 degrees. Therefore, in specifying the solubility of salts it is always essential that the temperature at which the measurement is to be taken is specified.

It may be stated as a general rule, also, that gases are less soluble with an increase in temperature. It should be emphasized at this point that different salts have different solubilities. As has been stated before silver nitrate is very soluble. Copper sulfate also is very soluble. At 80 degrees C. about 57 grams of copper sulfate will be dissolved in 100 grams of water. Sodium nitrate is even more soluble. At 20 degrees C. approximately 88 grams of this salt will be dissolved in 100 grams of water. However, silver sulfate is only sparingly soluble. Only 0.55 grams of this salt will be dissolved in 100 grams of water at 18 degrees C. Some salts are practically insoluble in solution and by this method they may be almost completely precipitated.

Barium sulfate in water is a very insoluble salt. At 18 degrees C. only 0.00023 grams of this salt will be dissolved in 100 grams of water. The electroplater makes use of this in determining the sulfate content of chromium plating solutions. The sulfate radical is present in the form of a soluble sulfate. If a soluble barium salt is added, such as barium chloride, the insoluble barium sulfate is formed. This can be weighed and the amount of sulfate calculated from the results. Thus, by using the facts of solubility, the electroplater can quantitatively determine the amounts of

different radicals in his plating solutions. It can be seen that a salt can be saturated without being concentrated. For instance, a small amount of barium sulfate present in water forms a saturated solution, but it is far from being concentrated.

Earlier the fact was mentioned that by evaporating a solution to dryness the solute is recovered, in the case of solids and liquids, as a dry solid. The dry solid will separate out in the form of crystals. These crystals can also be obtained by preparing a saturated solution at a high temperature and allowing it to cool, thereby precipitating some of the crystals. It will be noted that the solute of a material will always crystallize in the same shape. Thus, ordinary table salt (sodium chloride) crystallizes in the form of cubes. For this reason the crystalline forms of material can be used many times to identify the substances present.

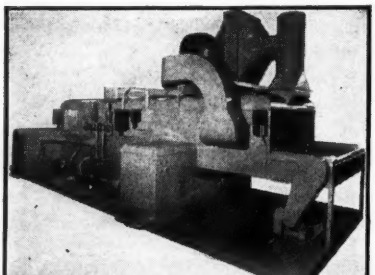
Many solids on crystallizing from solution do not crystallize as the pure solid but unite with some of the water. The amount of water taken into crystallization is not held very tenaciously, but definite amounts of this water always accompany crystallization. A good example of water of crystallization is shown when copper sulfate crystallizes. It will be found that five molecules of water accompany the copper sulfate, thus: $CuSO_4.5H_2O$. This water of crystallization can be separated rather easily from the copper sulfate by heating. Such a salt is said to be dehydrated or anhydrous. The salts with the water of crystallization are often called hydrates. Water of crystallization seems to have a definite effect on the color of copper sulfate as $CuSO_4$ is white, while $CuSO_4.5H_2O$ is blue. If water of crystallization is lost at room temperature, the process is called efflorescence. Usually the opposite takes place; that is, the water is absorbed from the atmosphere by the salt. This process is called deliquescence.

If a quantity of solute is added to a solvent it will be noticed that a definite increase in the boiling point or decrease in the freezing point takes place. A change has been found to be directly connected with the molecular weights of materials added. Thus, weights which are in the same ratio as molecular weights produce identical results. The boiling point of a solution is elevated 0.52 by one molecular weight of a non-volatile, non-ionizing solute in 100 grams of water. The freezing point of a solution is lowered (—1.86 deg. C.) for every gram molecular weight which is dissolved in the solute. This helps the scientist to determine the molecular weights of many solids and liquids.

In many cases solutions are composed of gases which have been passed through water. Thus:

$$H_2O + CO_2 = H_2CO_3$$
$$NH_3 + H_2O = NH_4OH$$

The last mentioned material, ammonium hydroxide, is very useful to the



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Henry discovered that an increase in pressure always increased the quantity of gas going into a solution. This is rather logical because the harder one pushes on a gas, the more it will have a tendency to dissolve in the water.

Solutions seem to be similar to gases in that the molecules of the dissolved materials move around through the molecules of the solvent. Much could be said at this point concerning the nature of solutions, but as it is of theoretical interest only this will be omitted.

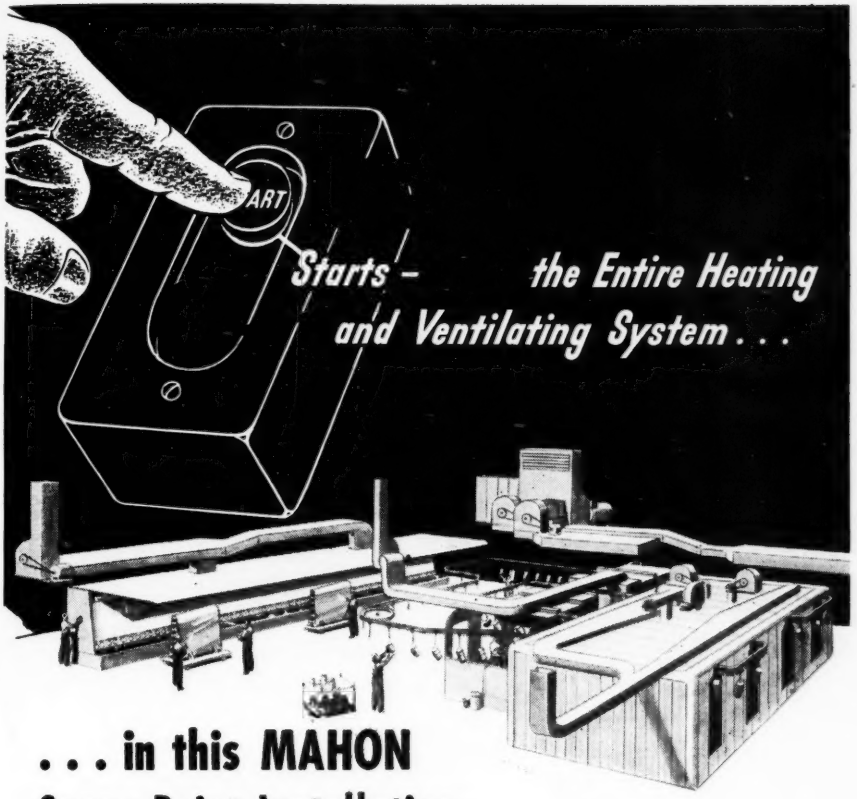
Colloidal chemistry, according to Bancroft, is a chemistry of grains, drops, bubbles, filaments, and films. Grains may be defined as small solid particles, drops as small liquid particles, and bubbles as small gas particles. In the case of filaments, all dimensions except one are small, while in films only one dimension is small. In every case these particles are completely surrounded by or dispersed in other materials. The diameter of these particles is from 200 millimicrons down to one millimicron, which is one-millionth of a millimeter.

Colloidal materials have been mentioned before. Milk, which is an emulsion consisting of a fat dispersed in water, was used as an illustration. Suspensions are mixtures which will settle out on standing. Muddy water is an example. Colloidal particles are not as small as particles of true solutions but they are smaller than particles in a suspension. Thus, one may say the colloidal solutions lie between true solutions and suspensions. It is quite possible for colloidal solutions to appear clear to the eye or with an ordinary microscope. However, if a strong beam of light is passed through a colloidal solution, the path of the particle becomes visible at once due to the fact that the particles suspended in the solution are large enough to have a surface which will reflect the light.

This phenomenon is rather common when one is standing in a dark room and a ray of light penetrates through a crevice. The atmosphere is polluted with dust and this makes the beam of light visible. An apparatus which is called the ultra-microscope is built to see the light which is reflected from the surface of the colloidal particles. It is possible to estimate the size of particles by simply observing the amount of light which is reflected. If colloidal suspensions are examined under the microscope, it will be found that they are continually moving around from place to place. This was observed by Brown in 1837, and is called the Brownian movement. This motion is due to the constant bombardment of the colloidal particle by the molecule of the material in which it is dispersed.

It is rather important to point out that in all colloidal solutions the material which is dispersed is insoluble in the dispersing medium. Milk is a colloidal solution of fat in water, the fat of course being insoluble in water. The material which is dispersed has very little effect upon the freezing point and boiling point of the solvent. This is due to the fact that generally the concentration of the particles is so slight that the effect is hardly noticeable.

Particles of true solutions are capable of migrating through a semi-permeable membrane, while colloidal solutions as a general rule are too large to do this. Therefore, it is possible to separate a colloidal solution from a true solution, using a semi-



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permeable membrane, a good example being parchment paper. This is known as dialysis and may be illustrated as follows: Suppose some salt is dissolved in milk. If the mixture is placed in a cup, the opening of which is covered with parchment paper, and the whole lowered into a container of water, the salt will slowly migrate through the parchment paper, leaving behind the milk.

In many cases small colloidal particles combine with each other to produce a larger particle. Soon a point is reached where the particle formed is too large to remain suspended and it passes out of the region of colloidal particles. In this way the particle precipitates out of solution. The above can be prevented by having certain materials present which will prevent the union of colloidal particles. The material added generally forms a protective film or coating around the small colloidal particles, thus protecting them from uniting with one another. These materials are generally called protective colloids. Thus, gelatin, a protective colloid, is added to colloidal solutions many times to prevent precipitation. Colloidal solutions may be composed of very fine particles of matter suspended in the air. Thus, fog and smoke are good examples.

At this point we may digress a moment and discuss a rather interesting effect of colloids. These particles, when dispersed, always carry an electrical charge. This may be proved by the fact that if a colloidal solution is electrolyzed, a colloid will generally migrate to the anode or cathode. One may see from this that the colloid will have either a positive or a negative charge. For example, an arsenious sulfide colloidal solution can be electrolyzed and it will be found that the yellow colloid moves toward the positive pole. Many metals and metallic sulfides bear negative charges when dispersed which means that they

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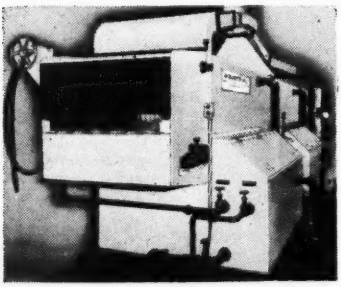

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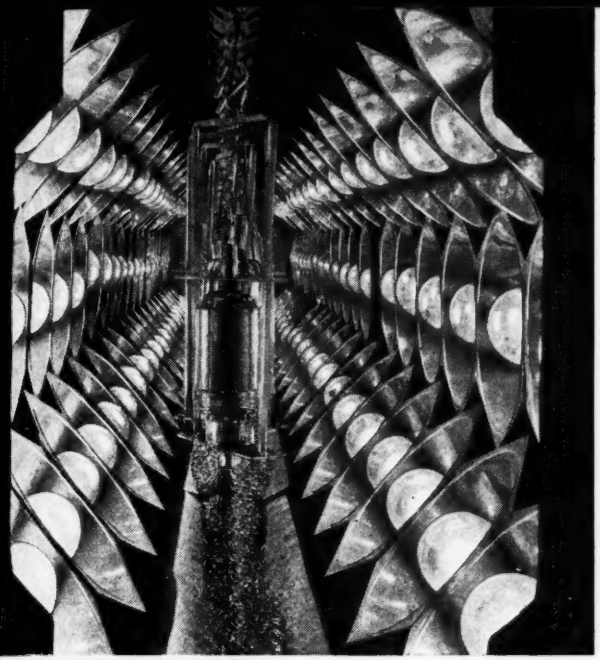

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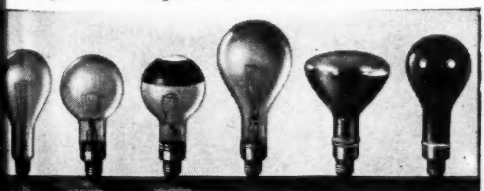

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will also migrate to the positive pole.

This same property is true if the colloid is suspended in a gas instead of a liquid. The solid or liquid particle will migrate to either the positive or negative pole. Cottrell, an American chemist, became interested in this phenomenon and applied it to industrial purification of gases. He found that smoke fumes from furnaces, dust from grinding processes, and so on, could be eliminated. In some cases an industrial hazard is removed, and in other cases it removes the industrial hazard and at the same time recovers valuable materials which would otherwise be carried off into the atmosphere.

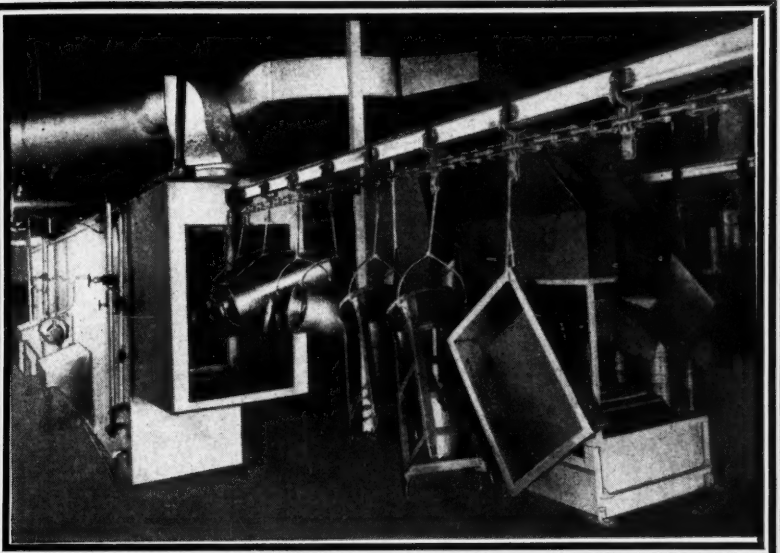
The apparatus for precipitating these colloids consist of a pipe being about 12 inches in diameter and 10 to 30 feet long. Inside the pipe is suspended a metallic conductor, generally a chain or rod, and both the pipe and the rod are charged electrically, the chain or rod having an opposite charge from the pipe. A very high potential is used so that the air may be rendered conductive. As the smoke or dust passes through the chamber, the particles being positively or negatively charged migrate either to the negative or positive pole and adhere to the container, while the gas passes on to the atmosphere in a clean condition. Thus, smoke and dust can be eliminated in the industrial plants. This is rather remarkable if one considers the fact that one cc of thick smoke may contain five million solid particles.

Colloidal chemistry is becoming very important to the electrochemist or electroplater. In the first place colloidal solutions are being used more and more for cleaning baths. The solid particles dispersed in solutions produce a rubbing or scouring action on the material to be cleaned and in this way assist in removing grease or dirt. Also, the surface of the colloidal particles may absorb the oil or grease. Colloidal particles may also be used as addition agents and in many cases help to produce better deposits. Good examples of solid particles in cleaning solutions are silicates and aluminum compounds, while gelatin, albumen, and licorice are examples of addition agents.

Undoubtedly the question has arisen in the reader's mind, "Does H_2O represent a molecule of water or has the scientist assumed this to be the case?" The same question can be asked concerning H_2SO_4 or any other formula that has been assigned to a certain compound. It should be emphasized at this point that H_2O represents exactly one molecule of water. The scientists have not assumed this to be the case, but nature has made it so. There are many ways of obtaining proof of these facts and a few of them will be mentioned here.

It is possible by laboratory means to determine the exact weight of one molecule of oxygen or one molecule of hydrogen, but these weights are so terrifically small that they mean very little. However, if a ratio is used, one can get the relative weights of the molecule which does mean many things to the chemist. For instance, if oxygen is given an arbitrary value of 16, every other element will have a corresponding weight; thus, hydrogen will be 1.008; aluminum, 27; cadmium, 112.41, and magnesium, 24.32. Every other element will have a definite corresponding weight. If the percentage of each element in a compound is divided by the atomic weight of the specific element in question, the simplest formula expressed in the composition of the material will be obtained.

It must be emphasized at this point that the simplest formula which is obtained gives only the ratio of the atomic weights of each element, and does not tell the real formula weight. To illustrate this, there are two compounds of hydrogen and carbon, both containing 7.75 per cent hydrogen



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and 92.25 per cent carbon; the simple formula is calculated as follows: 7.75 divided by 1.008 = 7.69 and 92.25 divided by 12 = 7.69. Thus, it will be seen that the result shows there is one part of hydrogen to one part of carbon which would give the formula of CH.

Now this same ratio can be used to represent many chemical compounds. For instance, it may be CH, C_2H_2, C_3H_3, C_4H_4, C_5H_5, and on up indefinitely as long as there are as many carbon atoms as there are hydrogen atoms. Thus, it can be said that this gives the ratio of the carbon to the hydrogen, but does not tell how many times the carbon and the hydrogen are used in each molecule. It so happens that in this case the CH is not the true formula. It is only the ratio of carbon to hydrogen. In order to know the true formula other information must be obtained. The formula CH represents a compound having a molecular weight of 12 + 1 = 13. On finding the molecular weights of C and H compounds, none have 13, but one does have a molecular weight of 26 and another 78. Thus, the true formula of these compounds are C_2H_2 and C_8H_8 respectively.

It has been pointed out earlier that the atomic weight x the specific heat = atomic heat. This is known as the law of Dulong and Petit and has been mentioned before. Thus, if the atomic heat, which is generally a constant, and the specific heat are known, one can solve for the approximate atomic weight. The atomic weight can also be obtained by comparing similar quantities of the material to the weight of oxygen.

Suppose the molecular weight of a compound is desired. It will be recalled that 22.4 liters of any gas at standard conditions represents a molecular weight. Thus, the molecular weight of a volume of gas can be obtained in this way. The molecular weight of a compound can also be

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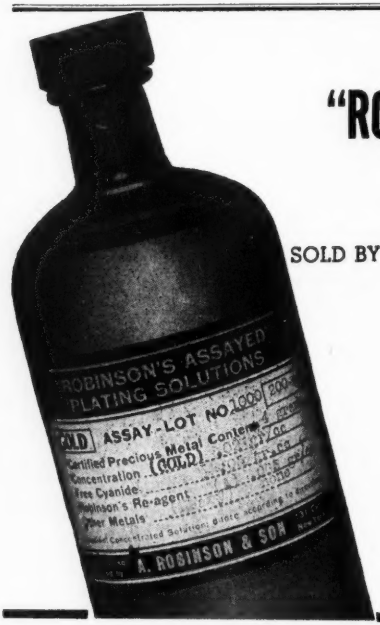
determined by raising the boiling point or lowering the freezing point as has been pointed out. It can be assumed that the smallest part of an element found in a gram molecular weight of its compound is the atomic weight of that element.

When one speaks of normal solutions, he speaks of equivalent weights. Perhaps this was not clear to the student at that time but a discussion here might make it clearer. Suppose that one analyzes sodium chloride and finds that 23 parts of sodium combine with 35.5 parts of chlorine to form the ordinary table salt. In this case it can be said that the combining weight of sodium is 23, while that of chlorine is 35.5. In the same way it can be seen that the sodium atom which weighs 23 can be replaced by the hydrogen atom which weighs only 1.008, but the hydrogen atom will make up a molecule uniting with chlorine as will the sodium. Thus, from the first case one will have NaCl and in the second, HCl. The hydrogen and the sodium unite with 35.5 grams of chlorine. Therefore, it can be said that 1.008 grams of hydrogen is equal to 23 grams of sodium and this assumption is correct.

In these cases it must be pointed out that the combining weights here are equal to the atomic weights, but this does not happen in every case, for in water, H_2O, there are two atoms of hydrogen combining with one atom of oxygen. Thus, a combining weight of oxygen is one-half its atomic weight because one oxygen atom will hold two hydrogen atoms.

It can be said that the atomic weight of an element is equal to its combining weight or some multiple of it. This multiple is generally a small whole number like one, two, three, or four. For sodium it is one. For hydrogen it is also one, but in the case of copper (cupric copper), it is two. In the case of nickel it is also two. In the case of aluminum



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it is three. If this is examined closely it will be seen that this small whole number corresponds to the valance of the element. Thus, for aluminum, the combining weight is 9 and its valence is 3. Therefore, its atomic weight is 27.

During the last few years some very good research work has been completed on the elements. This has changed our views somewhat and has explained some facts which were unexplainable before. One of these is the explanation of why some elements have an uneven atomic weight. For instance, chlorine has an atomic weight of 35.46, and many have sought ways of explaining this, but no good explanation was offered until it was found that all the atoms of an element are not alike. The atomic weights which are used happen to be the average of the atomic weights of different types of the atoms of the element under question. The different atoms of the same elements are called isotopes. The isotopes have the same chemical properties but slightly different weights. A good example is the isotopes of chlorine. Being two in number the atomic weights of these are 35 and 37 respectively. Many elements have these and lately Urey has found that even hydrogen has isotopes.

(Part 7 will be published in our April issue.)

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SOME years ago an inhibitor known as "Rodine" was developed which controls pickling action to the removal of scale and prevents needless attack on clean metal. In addition to making it possible to increase the speed of production, the use of Rodine is also said to result in savings in acid, metal and the reduction of hydrogen embrittlement.

Continued research resulted in the development of a further aid for pickling baths—ACP Pickle Bath Toner, for use with or without Rodine. It is said to improve the finish of pickled metals and reduce waste due to excessive dragout.

The toners are supplied in either a powder or liquid form for use in either sulfuric or muriatic acid solutions, producing bright, clean surfaces. The emulsifying action of the toners reduces the contamination of the pickle solution by oil; this characteristic adapts them to the pickling of slightly oily work and, in conjunction with Rodine, to the pickling of alloy steels that are difficult to pickle.

The toners, in both the powder and lquid grades, are furnished with and without inhibitor action. The uninhibited types are recommended where the advantages of the toners can be combined with those of the inhibitor, Rodine. In such cases both are added to the new pickle bath and as future additions of acid are made, only the Rodine is added.

In a few operations where strong inhibitor action is not required, for example in cold pickling solutions or where actual attack or "etching" of the metal is desired for subsequent operations, the use of the mildly inhibited form of the toner is recommended to obtain the improved cleaning action and still retain sufficient inhibition to prevent excessive etching.

During March the American Red Cross will raise its 1944 War Fund. A goal of $200,000,000 has been set. This must be met if the Red Cross is to continue its work on an undiminished scale. Let's give!

SAVE HOURS of PAINTING TIME

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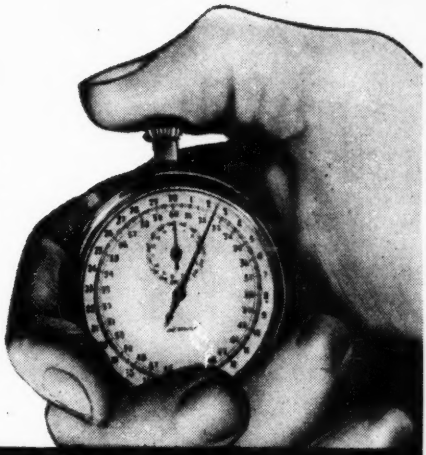

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Cut down slow-downs and time-out by cutting out paint smell...with Ridsmel. Quick-acting! Safe! Ridsmel is a concentrated liquid paint deodorant effective in any paint, varnish or enamel. Used in industrial plants and shipyards, coast to coast.

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Things to Come

IN an address made recently before the members and affiliates of the Technology Club, Dr. Howard E. Fritz, Director of Research of the B. F. Goodrich Company, stated:

"We are all hurrying to put this war behind us, and in due course we shall return to our conquest of nature for the benefit rather than the destruction of mankind. We shall then fully utilize the dynamic force of this great power, American research.

"Here are some of the things we may expect:

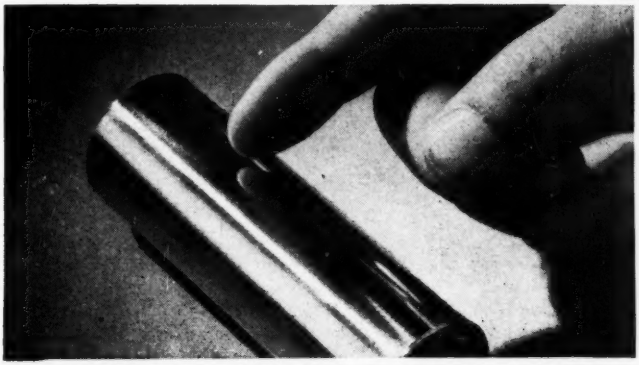
1. Aluminum, once a rare metal, in fantastic volume at low prices.
2. Magnesium at one-fifth the weight of steel from an inexhaustible source, the sea.
3. Triptane which is trimethyl butane; 150 octane motor fuel; a 'designed' molecule.
4. Thousands of low cost abundant raw materials from petroleum, unknown commercially before.
5. A cloth-like material which needs no weaving, from mixtures of natural and synthetic fibers, by the use of paper-making technique.

   The trick is that the thermoplastic fibers weld together the others. Even now, due to war shortages, a material of this sort has replaced the old cloth tea bag. We may even come to the day when we can have new, fresh clothes whenever we wish to change our synthetic linens, or send in our suits to be reclaimed.
6. Non-shatterable glass and glass fibers with tensile strength of 3,500,000 pounds per square inch, ten times that of mild steel.
7. A chemical which provides a sort of invisible raincoat for anything that is dipped in it. Yet our microscopes reveal no film upon the substance so treated.
8. New rubber, not as we have known it heretofore, but hundred of rubbers and materials with rubber-like properties, performing unique and unexpected jobs and made from wheat, corn, garbage, soybeans, coal, petroleum, limestone, milk, sweet potatoes and salt.
9. Germ-killing chemicals, new anesthetics, synthetic vitamins and medicines prolonging and saving man's life under the new hazards and conditions.
10. Electronics and the electron, including television, frequency modulation and the electric eye. Ships and trains will no longer collide, and aircraft will not crash in flight."

Cleaner 100. The Enthone Company has just published a four-page bulletin in color describing an alkali steel cleaner called "Cleaner 100." This cleaner is designed for the cleaning of steel by either immersion or electrolytic means. Advantages of the cleaner are outlined. For a copy of the bulletin write to The Enthone Company, Dept. PF, 442 Elm St., New Haven, Connecticut.

Burnsrouges. A number of the rouges for cutting or coloring marketed by E. Reed Burns Manufacturing Corporation, 41 Withers St., Brooklyn 11, N. Y., under the trade name "Burnsrouges" are described in a circular which has been prepared for distribution. The line includes 15 standard grades and other grades for special purposes. Copy free upon request.

The NEW Metal Cleaning



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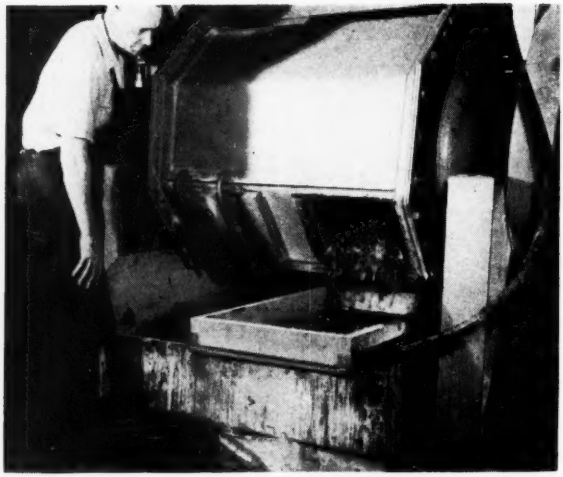
- Solventol No. 27 — 1 to 40 in water — in a single, fast, washing stage — frees any part completely of all deposits
- And—creates an extraordinary surface passivity—preventing rust, corrosion, and hand soiling for days
- Solventol No. 27 is a timely advance in the new science of synthetic fluid surface cleaning and conditioning
- A dramatic climax to eleven years of research—and success in major industrial installations
- No. 27 can be used in most standard washers—or our complete engineering service will design faster, specialized units for you
- Telephone, wire or write — Solventol Chemical Products, Inc., 15841 2nd Ave., Detroit, Michigan.

SOLVENTOL

MODERN SYNTHETIC FLUIDS FOR WATER SPRAY WASHING



Modern Precision Methods at Nash-Kelvinator

AT NASH-KELVINATOR plants one of the major problems involved in the mass production of complicated modern mechanisms is the deburring or removing of sharp machined edges from the corners and facets of the parts. Millions of man-hours annually are expended in industry on this tedious operation.

As its war production rapidly expanded, Nash-Kelvinator Corporation began to experiment, in all of its plants, with the tumbling technique in attempts to reduce the heavy labor time required by manual deburring. The results have been so successful that now nearly 100 tiny intricate parts of airplane engines, propeller hub mechanisms, and control instruments are being deburred mechanically in various types of "tumblers."

Twenty-six girls were formerly kept busy filing off the rough edges of a very small part for the Pratt and Whitney aircraft engines being turned out by Nash-Kelvinator. Now, one man does the same job with a tumbling barrel and runs two other tumblers at the same time. The girls have much more productive jobs elsewhere in the plant.

Each of these aircraft engines requires 700 of a certain type of washer. Previously, a hand operator could smooth off 45 of these washers in an hour. A tumbling machine now does 5000 an hour.

One special part of the engine has 64 different "facets" which were being manually filed at the rate of five per hour with considerable "salvage" when the file slipped. The barrel can do 175 of these hour and never damage a one.

In the company's Lansing plants, where Hamilton Standard hydromatic propellers are produced, a tiny but very special nut was the problem. One operator could file off only 12 per hour by hand. Now one tumbling barrel rotating at just the right speed and filled with agate pebbles about "slingshot size" can deburr 1200 nuts per hour—a 10,000 per cent increase.

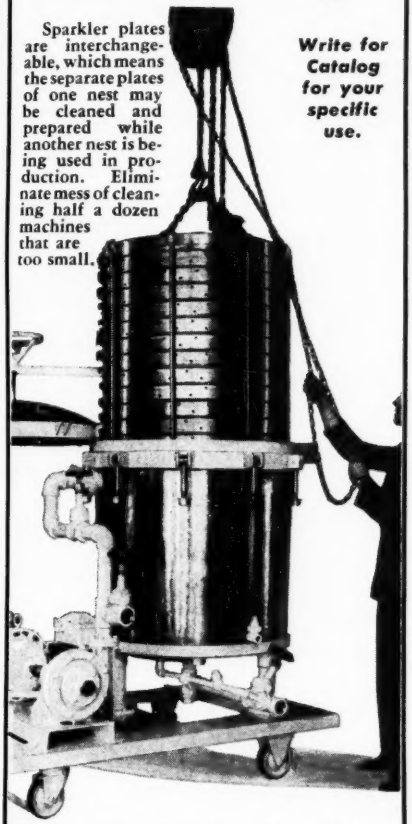
So successful have the Nash-Kelvinator engineers been in widening the use of these mechanical stone tumblers that they are now adapting them to various polishing operations. Considerable progress has already been made in this direction.

Changing plates

Almost a white collar job.

Sparkler plates are interchangeable, which means the separate plates of one nest may be cleaned and prepared while another nest is being used in production. Eliminate mess of cleaning half a dozen machines that are too small.

Write for Catalog for your specific use.



Sparkler Filters clarify or purify any fluid in any quantity, using any filter aid that produces the finest results at greatest speed.

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SPARKLER FILTERS HORIZONTAL PLATE

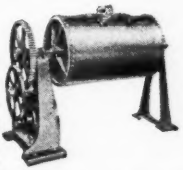
GLOBE
Finishing • Tumbling
BARRELS

The Globe complete line of finishing tumbling barrels has had the acceptance of industry for more than 40 years.

GLOBE DIRECT MOTOR DRIVE, TILTING, TUMBLING BARREL.

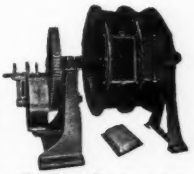
(Right)—Speeds as low as 30 r.p.m. Developed to produce fine finishes on nonferrous parts. No nicks or scratches. Quality built with compactness. Available with wood, steel or cast iron shells.

No. 6 HORIZONTAL FOUNDRY BARREL.



(Right) — Ruggedly constructed for heavy duty work such as removing fins and flanges from castings. Available in varied sizes with tight and loose pulleys or motor drive as shown.

COMPARTMENT BURNISHING BARREL.



(Right) — Performs up to three jobs at once, speeding production. Exceptionally strong and durable. Large door opening facilities loading and unloading. Belt or motor driven.

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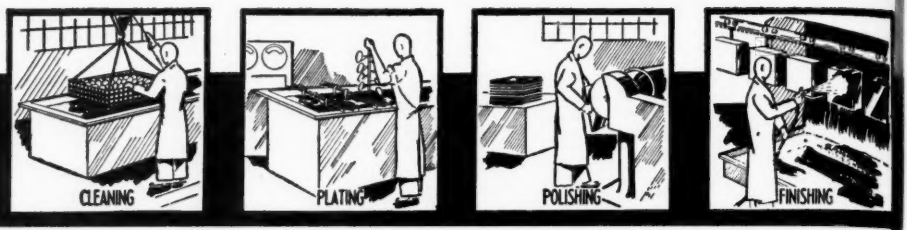

News of the Industry

A.E.S. June Conference

As we approach the forthcoming June Conference of the American Electroplaters' Society, we begin to gather news about some preliminary plans for a rousing program which the Society expects to arrange for their Cleveland session.

It is hoped that those members of the Society who may be called upon for their knowledge and achievements in the electroplaters' field, as well as for the perfections of new applications, will stand ready to share them with their brother members.

All members are being urged to attend the Cleveland Conference for what benefit they will derive from the numerous papers that will be presented on timely subjects, including some that may involve postwar activity.

It has already been suggested that those who intend to be at the June Conference should not delay in making arrangements for hotel accommodations either at the Hotel Cleveland, which will be the headquarters, or elsewhere if you have a favorite hotel. As is customary, those who make early reservations will get first consideration.

Next month we plan to give you additional news about this important event, including reliable information about hotel rates and accommodations.

New Detroit Representative

A. H. Freeman has joined R. L. Orth in representing the American Foundry Equipment Co., Mishawaka, Ind., in the Detroit territory, filling the post vacated by the death of M. T. Mortensen. During the past seven years Mr. Freeman has acted as sales representative in northern Indiana and southern Michigan areas.

He has been with the company since 1918. Before his appointment to sales work, Mr. Freeman occupied numerous posts in the manufacturing and service divisions. In 1935 he was given the responsibility of helping the company's British licensee, Tilghman's Patent Sand Blast Co., Ltd., in setting up manufacturing processes for airless Wheelabrator blast cleaning equipment.

Pennsalt New York Office

The Pennsylvania Salt Manufacturing Company moved its New York office on February 1st to 40 W. 40th St., New York 18, N. Y. The New York office is the headquarters of two of the company's sales districts — one headed by F. G. Rodenburgh and the other by C. A. McCloskey.

Jones-Dabney Makes Appointment

George K. Graves has been appointed director of automotive sales of Jones-Dabney Company, Louisville, Ky., with headquarters in Detroit. Mr. Graves is a graduate of Penn State with a degree in chemistry. After one year of research work, he became technical advisor on lubricating oils for Standard Oil of Indiana. For the past 16 years, he has been in the sales department of Ditzler Color Company, the last eight years of which he has been assistant sales manager.

Cowles Research Expands

The Cowles Detergent Company, 7016 Euclid Ave., Cleveland, Ohio, announces the appointment of Dr. Clinton W. MacMullen as technical director in charge of the company's rapidly expanding research and technical service programs. A graduate of the University of Minnesota from which he also received his

Dr. Clinton W. MacMullen

doctor's degree, Dr. MacMullen comes to the Cowles organization from the Rohm & Haas Company.

Other recent appointments to the Cowles research and laboratory staffs are: Daniel A. Cook, who graduated in chemistry from the Massachusetts Institute of Technology, and has had extensive experience in the textile chemistry field and comes to Cowles from the North American Rayon Corporation; Ruth Mary Marsh, who received her undergraduate and post-graduate degrees in chemistry and physics from the University of Chicago, and Cornelius W. Pettinga, formerly of the faculty of the chemistry department of Syracuse University.

Brandt Joins Pennsylvania Salt

L. H. Brandt, Ch.E., formerly with the National Ammonia Division of Du Pont, has joined the technical service department of the Pennsylvania Salt Manufacturing Company, Philadelphia, Pa., according to an announcement by L. L. Hedgepeth, manager of technical service. Mr. Brandt, a native of Ironton, Ohio, was educated at Denison University and Ohio State, receiving the degree of B.Ch.E. from the latter institution in 1929 and his Ch.E. in 1938. During his service with Du Pont's National Ammonia Division, which covered a period of more than 10 years, he has been prominently identified with ammonia and other heavy chemical utilization in the fields of refrigeration, oil refining, and heat treating.

In his new position with the technical service department of Pennsalt his services will be principally devoted to rendering assistance to heavy chemical users.

Spring Convention of Electrochemical Society

The Electrochemical Society, Inc., has announced plans for its spring convention to be held in Milwaukee, Wis., from April 12 to 15. The headquarters for the convention will be the Pfister Hotel, which is centrally located and easy of access.

There will be three main sessions: (1) Powder Metallurgy, sponsored by the Electrothermic Division; (2) Industrial Electrolysis, and (3) Corrosion. An exhibit of South American raw materials and products has been planned. The emphasis will be laid on electrochemical products and materials.

Tobler Chemical Moves

Harold S. Guy, president of The Tobler Chemical Company, formerly of Portland, Conn., has announced that the company is now located in a new plant at 28 Oliver St., Boston, Massachusetts.

Alcoa Announces New Positions

Aluminum Company of America, Pittsburg 19, Pa., has announced the appointment of two industry managers in the railroad and automotive fields. John O. Chesley, head of the Sales Development Division, has been named railway sales manager for the railroad field and Frank C. Barrows, Jr., Detroit, has been appointed automotive sales manager for the automotive field.

Alcoa officials pointed out that the creation of the two new positions will not in any way alter the present sales organization of the company. They were created in order to provide a direct contact between the Aluminum Company and the railway and automo-

tive markets in meeting the anticipated demand for aluminum in these two fields after the war.

Mr. Chesley has been associated with Alcoa for 32 years and for the past ten years has been head of the Sales Development Division. Mr. Barrows came to the Aluminum Company as an apprentice on January 1, 1913, and, except for the period of World War I, has been continuously associated with Alcoa since that time.

Suceeding Mr. Barrows as district sales manager in Detroit will be Charles M. Whelan, who has been assistant manager at that point for a number of years. Mr. Whelan also has had long years of experience in the organization, having been with Alcoa for the past 26 years. Since 1927 he has been connected with the Detroit sales office of which he now becomes district manager.

Assistant Technical Director

The Watson-Standard Company, Pittsburgh, Pa., announces the appointment of Charles H. Groff as assistant technical director of the company's rapidly expanding research laboratory staff. Mr. Groff comes to his new position from the research department of the Crown Can Company, Philadelphia, where he was chief chemist of the Lacquer Division. Prior to this he was associated with the Resinous Products and Chemical Company.

Mr. Groff attended Temple University, and is a member of the American Chemical Society and the Pittsburgh Chemists Club.

Walter Linley Hague

Walter Linley Hague died on December 17, 1943, at his home in Pittsburgh, Pa., at the age of 71. Mr. Hague, who had spent the last few years in retirement, was one of the pioneers in the contract and jobbing electroplating industry, having operated Walter E. Hague and Son, Inc., which had been founded by his father, Walter Edward Hague, in 1869. This company was in continuous operation for over 65 years until Mr. Hague's retirement. He was widely known not only in the Pittsburgh district but also nationally, having taken an active part in the work of the American Electroplaters' Society. A son, Louis M. Hague, is vice president in charge of sales of the Hanson-Van Winkle-Munning Co., Matawan, New Jersey.

Compressed Gas Manufacturers Elect Coyle

Thomas Coyle, chlorine products manager of the Electrochemicals Department of E. I. du Pont de Nemours & Company, was recently elected president of the Compressed Gas Manufacturers Association, Inc., at New York.

Mr. Coyle joined the Du Pont Company in 1930 when the company acquired Roessler and Hasslacher Chemical Company with which he had been associated 26 years.

Born at Perth Amboy, N. J., he attended Bethlehem Preparatory School and then was graduated from Lehigh University as a chemical engineer. He had been employed by Roessler and Hasslacher before attending the university and at the conclusion of his course returned to the firm in 1909. He has been manager of chlorine products since R. & H. interests were purchased by the Du Pont Company.

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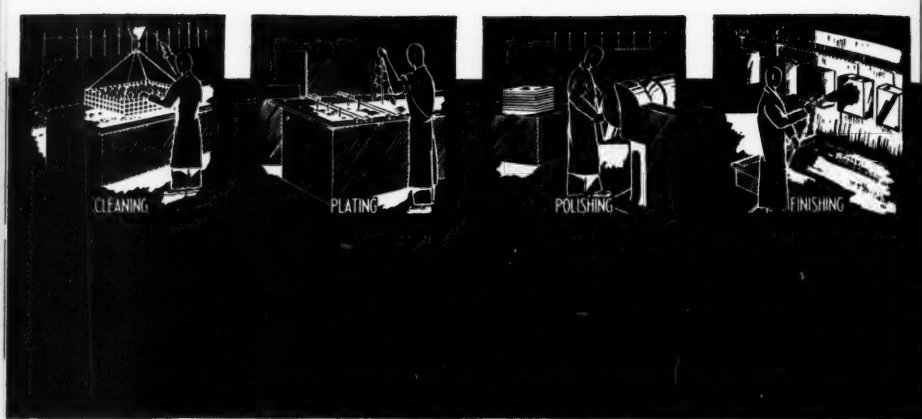


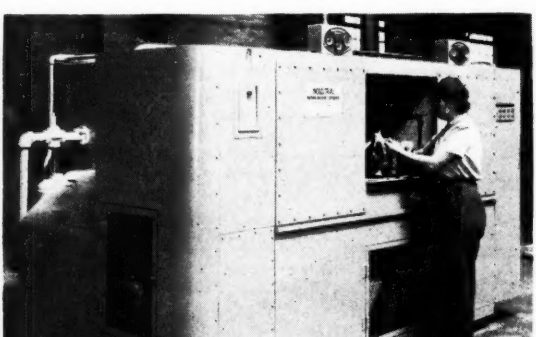
"Industrial" Segmented Cabinet Washing Machine

The machine pictured here, a product of the Industrial Washing Machine Corporation, 290 Burnet St., New Brunswick, N. J., is known as the segmented cabinet washing machine. The machine consists of a large mesh turntable (or special fixtures depending upon the nature of the work to be cleaned), which rotates slowly. Surrounding the turntable is the housing which is portioned off into various combinations of washing, rinsing or slushing, and drying.

The parts to be cleaned are placed either directly upon the mesh or on the fixtures. As the turntable rotates it carries the work through the above-mentioned cleaning operations and returns it to the same operator who does the loading. Production ranges from 2 to 10 sq. ft. of work per minute.

Advantages claimed for this unit include the following: (1) only one operator needed; (2) small floor space occupied, 11 x 7 ft.; (3) maximum spray coverage; (4) experienced operator not necessary, and (5) any of the cleaning detergents now on the market can be used in this machine.

Machines of this type are now in use for cleaning cylinders, gears, piston rings, connecting rods, master rods, pistons, machined castings, die castings, rocker arms and flexible metal conduit.



"Industrial" Segmented Cabinet Washing Machine

Oakite Compound No. 86

Previously restricted for exclusive use in war plants to meet production requirements for the better bonding of organic finishes and the prevention of rust in preparing steel parts for painting, lacquering and similar finishes, an acid-type detergent designed to clean and condition ferrous metals has been released to all types of metal-working plants by Oakite Products, Inc.

Developed primarily for use in automatic washing machines, this material

known as Oakite Compound No. 86, is reported to combine, in one operation, effective detergent action with special rust-inhibiting surface treatment. The material thoroughly removes light spinning compounds, drawing lubricants, machining oils, grease, finger marks and shop dirt. At the same time, it deposits on the work a microscopic crystalline coating which provides the base for firm bonding of subsequent paint, lacquer and similar finishes.

It contributes to fast production by eliminating the need of preliminary alkaline degreasing in preparing steel for organic finishes. Another of its advantages is the prevention of rust on parts between operations.

A Special Service Report, describing the material in detail, method of using and its application, is available on request to Oakite Products, Inc., 20 Thames St., New York 6, New York.

Heil Portable Heating and Dipping Tank

A portable heating and dipping tank, which includes an acid compartment, has been developed by the Heil Engineering Company, 12901 Elmwood Ave., Cleveland, Ohio. The tank has a number of distinctive features.

Known as a "utility tank" and designed for a wide variety of uses, the tank is divided into three compartments which are basically designed for degreasing, rinsing and pickling. However, it is also said to be perfectly suited for etching, plating, metal coloring, waxing, fluxing, oiling, lacquering, dip painting, rust removing, macro and salt spray testing, anodizing, pilot and laboratory operations, and so on. Because of its unusual flexibility and portability, it is suitable for any manufacturing plant, machine shop, public utility or laboratory.

An unusual feature is a dual-purpose cover and shelf, which is thoroughly acid-proofed and arranged to drain into the tank.

To operate the tank, it is necessary only to fill the compartments and plug the flexible extension cord into any 110 or 220-volt circuit. Compartment No. 1 is furnished with a standard heating unit for hot alkaline degreasing compounds; compartment No. 2 is for cold rinsing, and compartment No. 3 is lined with Plast-O-Ply, an acid-resistant coating suitable for pickling acids such as sulfuric, muriatic, phosphoric, hydrofluoric and oxalic, in dilute solutions. This lining is also satisfactory for most electroplating chemicals, including alkali, acid or salt compounds; for acid cleaners used on aluminum and magnesium, and for corrosive fluxing salts.

Heating units can be supplied extra for all three compartments if required. An insulating wall between compartments Nos. 1 and 2 prevents heat loss from compartment No. 1 when compartment No. 2 is used without heat. All compartments are equipped with bottom and overflow outlets. Heating units are equipped with automatic temperature control.

Heil Portable Heating and Dipping Tank

The tank is integral with a welded steel frame, equipped with swivel casters. Overall size of standard models is 20 x 56 x 36 in. high, although special sizes of the same equipment are available. In standard models, compartments are made to accommodate 12-in. round or square baskets. Any model, standard or special, can be moved anywhere with ease. Special linings, including steel, lead and Koroseal (the latter for use with nitric and chromic acid solutions and other oxidizing chemicals), are also supplied on request. Other extras include indicating thermometers, acid-proof electric heating elements, gas-fired heaters, dipping baskets, and so on.

"Black Magic" Coloring Processes for Gages

According to an announcement made by the Mitchell-Bradford Chemical Co., 2446D Main St., Stratford P. O., Bridgeport, Conn., the Black Magic processes developed by this firm for coloring met-

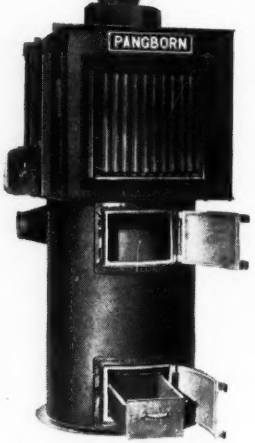
als are now being widely used in treating plug, ring and other types of gages as a means for indicating surface wear.

Black Magic is said to penetrate the surface of a gage not more than 0.0001 in., providing a deep black finish which is easily distinguished from the color of the steel so that when the gage is worn beyond this amount (0.0001 in.), the bare metal is shown in sharp contrast. The finish imparted to the gage becomes a part of the steel itself and does not change the precision dimensions, surface hardness, or wearing qualities of the gage, it is claimed. Scratches and nicks are also said to show up vividly when gages are thus finished.

The color is applied to gages by boiling them in a special salt solution, followed by rinsing in cold water. The finish provided is said to protect the gages from corrosion and stain from the workers' hands.

Pangborn Type "CK" Unit Dust Collector

A unit type industrial dust collector of rugged construction, designated as the Type "CK," has been placed on the market by Pangborn Corporation, Hagerstown, Md. The unit is designed for smaller air volume dust control problems where a self-contained unit is indicated.



Pangborn Type "CK" Unit Dust Collector

The unit consists of two major sections—a preliminary centrifugal section and a secondary cloth screen section. Dust-laden air enters the centrifugal section where, due to a reduction in air velocity and centrifugal action, the bulk of the entrained material is separated from the air stream. The air, containing only the finely divided dust particles, then flows upward to the secondary cloth screen section where the fine dust is effectively filtered from the air. The cleaned air thence passes to the exhauster and is discharged. The cloth-covered screen frames are provided with a shaking device which is operated at intervals, with the exhauster shut down, to free the cloth surfaces from collected fine dust. This dust, together with that precipitated from the preliminary centrifugal section, is deposited in the common dust drawer or receptacle for removal and disposal.

The collector is available in three sizes: No. 215 "CK"—1,000 c.f.m. capacity, 3 h.p. exhauster motor; No. 220 "CK"—2,000 c.f.m. capacity, 5 h.p. exhauster motor, and No. 223 "CK"—3,000 c.f.m. capacity, 7½ h.p. exhauster motor.

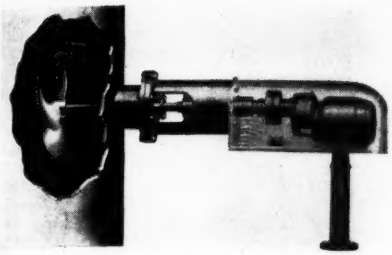
"Skalite" Process of Chromium Plating

Warner Electric Company, 360 N. Michigan Ave., Chicago 1, Ill., has announced the development of a chromium plating process to be known as the "Skalite" Process. The process, with its Skalite chromium salt, is said to increase plating efficiency and to simplify the procedure for both hard and decorative chromium plating. The method is simple and automatic, not greatly different from copper plating.

A minimum of time, electrical energy and salts are required. Special contour anodes are not needed on intricate objects due to the bath's non-gassing characteristic and increased throwing power. The bath is said to be non-corrosive. Constant testing of the bath by trained chemists is unnecessary.

Porter Side-Entering Agitator

A side-entering agitator, which can be repacked from the outside without draining the tank and without loss of liquid, has been introduced by H. K. Porter Company, Inc., Pittsburgh 1, Pa. So important are the advantages incorporated



Porter Side-Entering Agitator

that the company is in process of replacing its entire standard line of agitators, from ½ to 30 h.p., with the new design.

The outside repacking can be done in five minutes, saving many man-hours, and the expense of draining the tank, airblowing it in cases where toxic fumes make this necessary to permit a workman to enter, and then pumping back the fluid after the packing has been replaced. This is accomplished by using an external packing gland, while a seal attached to the shaft inside the tank may be drawn into a seat, hermetically sealing off the contents of the tank and permitting repacking with the tank full and no loss of liquid.

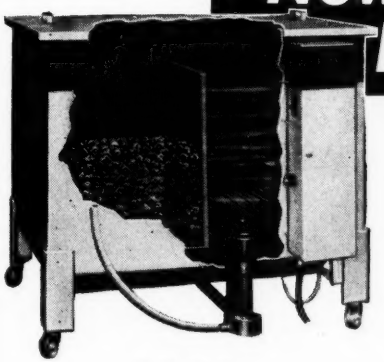
The agitator has been completely reengineered. All thrust is taken off the motor bearings by means of roller bearings operating against a ring attached to the shaft. This feature is said to result in longer life for the motor gears and consequently for the motor. Also, by means of undercuts, the designers have made it impossible for leakage to get at the bearings, not only adding to their life but also simplifying lubrication and elminating the need for special lubricants.

The unit is also completely weatherproofed with all moving parts protected from the elements, and can be installed outdoors with entire assurance. The motor base and cowl are integrally mounted to the agitator, and the unit is equipped with an adjustable support under the motor base. A hinged weatherproof cowl on the motor gives easy access to the motor.

Kidde Wheeled Extinguisher

Kidde Model 100 wheeled fire-extinguishers, now manufactured by Walter Kidde & Company, Inc., 245 Main St.,

New Method of DEGREASING



Speeds Up Vapor Degreasing by More Than 33⅓%—Safer, More Economical

Developed by Phillips, the PHILLSOLV vapor degreasing solvent is tops for efficiency. It cuts vapor degreasing time by one third! Reduces vapor loss. Handles wider range of greases. Gives more thorough penetration of close, nested parts of ferrous and non-ferrous metals. Low toxicity — higher safety factor. PHILLSOLV, non-water soluble, has many applications in instrument and war plants. No corrosive action.

Complete Line of Electrical Vapor Degreasing Machines

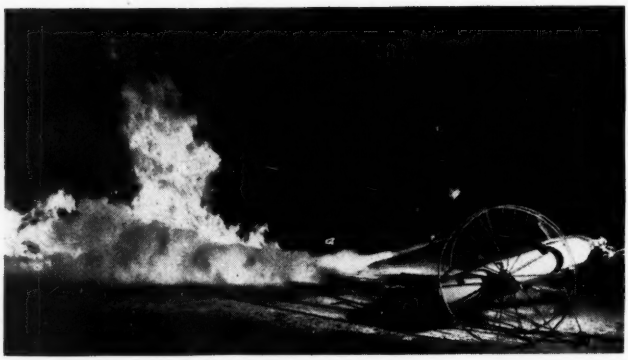
A machine for every type of job. Portable—can be moved to the job. Requires no gas, water or steam lines. Many other features. Write for catalog.

FREE

DEGREASING MANUAL

Contains specific information on degreasing problems, solvents, solvent toxicity and control, solvent recovery, and many practical applications.

PHILLIPS Manufacturing Company • 3494 W. Touhy Ave. CHICAGO, ILLINOIS



Kidde Model 100 Wheeled Extinguisher in Use

Belleville, N. J., with a non-conducting plastic nozzle shield, combine the quick mobility of portable units with fire-fighting power of 100 lb. of highly compressed carbon dioxide.

Designed to protect larger hazards than hand portable extinguishers could handle, the wheeled units provide fast action and heavy duty extinguishing. The shielded nozzle is equipped with a long handle-grip and a shut-off valve which permits conservation of the gas during changes of fire-fighting position.

Like other Kidde extinguishers, the Model 100 is Underwriters' Laboratory approved, bearing their B and C rating as suitable for all flammable liquid and electrical fires. These large wheeled-type extinguishers protect special oil and electrical hazards in power plants, as well as oil pumping stations, garages and large storage spaces.

Lead Plating Solutions

For the protection of iron and steel against corrosion and to obtain a corrosion-resisting coating on non-ferrous metals, electrodeposited lead has been used to a limited extent for many years. The use of lead coatings as a substitute for more critical metals is increasing and may assume considerable proportions. Through an extended laboratory investigation several lead solutions have been developed by the Hanson-Van Winkle-Munning Co., Matawan, New Jersey.

Concentrated Protecto Lead Solution is now substantially improved by recent changes in the formula. To prepare a working solution, simply add three parts of water to one part of concentrate. The resulting Protecto Lead Solution is for general purpose plating at low to medium current densities. The plating range is from 5-15 amps./sq. foot.

Super Protecto Lead Concentrate is a well-balanced concentrate, to be diluted with equal parts of water to form an electroplating bath. It is a modern solution for general purpose plating. As the metal concentration of the working bath is four times that of the Protecto Lead Solution, the current density range is extended to 30 amps./sq. ft. or even higher with suitable agitation. The throwing power of this solution is also higher. The solution is recommended for barrel plating.

B-H Lead Solution is not concentrated, but is used for lead plating as prepared. It is designed especially for lead plating of bearing surfaces, but is also excellent for general purpose plating. The B-H Lead Solution produces deposits with the proper micro-structure for subsequent indium plating and heat treatment. Before the material leaves the manufacturer, samples plated in the solution are examined microscopically to make certain that the structure is correct and that the deposits are free from harmful inclusions.

"Emeri-Crete" Floor Patching Material

"Emeri-Crete," a permanent type floor patching material now being marketed by the Walter Maguire Co., Inc., 330 W. 42nd St., New York 18, N. Y., is intended primarily for use in filling cracks, small depressions, ruts and other imperfections in concrete or cement floors. It was developed to meet a demand for a ready-mixed material which could be applied immediately after water had been added.

Emeri-Crete is composed of the same pure emery that comprises Cortland Emery Aggregate. However, in Emeri-Crete, only the smaller particles of emery are used. These are mixed with a special quick-setting binder which al-

lows for use of the floor six or seven hours after the repair has been made.

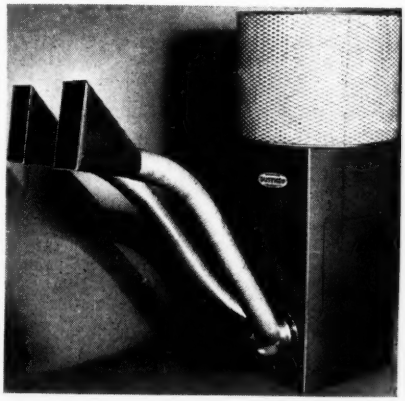
Emeri-Crete is supplied in small packages, permitting the use of just the right amount of material to do the job at hand with no waste. Complete instructions for mixing and applying are furnished with the material.

According to the manufacturer, Emeri-Crete will not shrink after application, has excellent adhesive properties and, if applied in accordance with directions, will provide permanent repairs.

"Dustkop" Model 950 Dust Collector

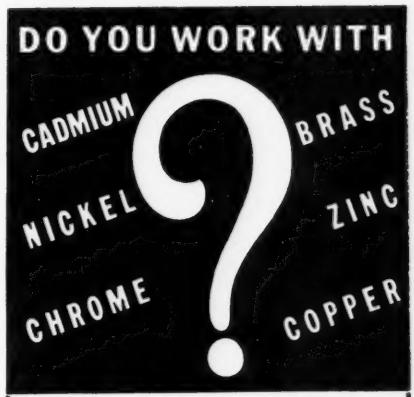
A portable dust collector of the cyclone-filter type for exhausting dust and dirt-laden air from most types of medium-heavy abrasive operations has been added to the line of "Dustkop" dust collectors marketed by the Aget-Detroit Co., 604 First National Bldg., Ann Arbor, Michigan.

Designated as the Model 950, the unit is entirely self-contained, having a multiple blade fan direct driven by a continuous duty motor, and a removable spun glass filter together with a cyclone type separator—a combination which allows the cleaned air to be recirculated into the working space in order to reduce heating losses to a minimum.



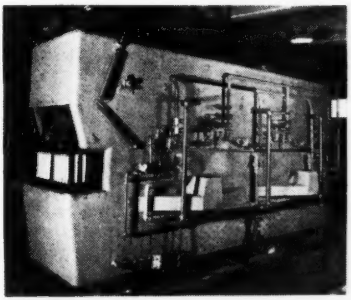
"Dustkop" Model 950 Dust Collector

Recommended for collecting dust from production grinding operations on large wheel surface grinders, medium size double-end grinders, cut-off machines, emery and belt sanders, the Model 950



then HOWARD can help you...

No matter what metals you use, HOWARD builds cleaning and finishing machinery which meets perfectly every operating requirement. Many of the nation's leading plants depend on HOWARD experience and equipment to solve tough cleaning and finishing problems. For most efficient results, consult HOWARD Engineers ... for recommendations on costs, methods, machinery. No obligation. Send for new catalog.



HOWARD Conveyor-Type Pickling Machine

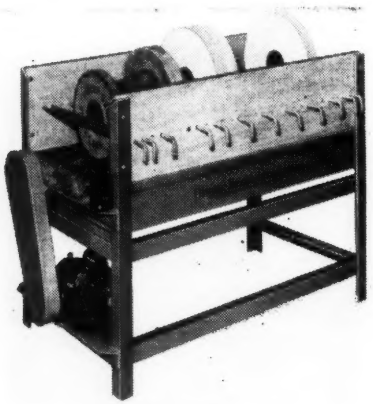
HOWARD Engineering & Mfg. Co.
1056 HULBERT CINCINNATI 14, OHIO

is powered by a ⅓ h.p. continuous duty motor and is rated at 490 cu. ft. per minute with a single 5-in. inlet. An air velocity of 4,450 ft. per minute with this inlet is considered ample for conveying dust from all types of abrasive operations.

Sufficiently light in weight so that it can be moved about as required, the Dustkop Model 950 requires less than two square feet of floor space; it can be supplied with either one-way or two-way inlets. Connections between the source of dust and the collector are usually made by means of flexible metal hose without the use of tools.

Divine Polishing Wheel Washer

To save time and effort of polishers, to save wear and tear on diamonds and avoid irregular cutting of wheels to re-head them, the wheel washer shown in the illustration was designed by Divine Brothers Company, 102 Whitesboro St., Utica 1, N. Y. It is said to extend wheel



Divine Polishing Wheel Washer

life by uniform head removal via the wet method and is particularly adapted to leather-covered wood (strap-faced) wheels.

Self-contained, the washer can be plugged into any electric outlet. Several wheel heads can be gradually and uniformly soaked off at one time. Immersion of the bottom of the rollers in water makes it possible to apply a thin film of water to each wheel's face so that the abrasive is removed without injury to the wheel body. Wheels of different diameters up to 24 in. can be separated by inserting wheel-separating rods. The rollers are driven by a ¼ h.p. gear-type motor, 110-220 volts, 60 cycles, single phase.

Protective Film for Magnesium Alloys

Discovery of a protective coating which enhances the use of magnesium in the construction of large aircraft was revealed recently by Consolidated Vultee Aircraft Corporation. Development engineers describe the electrically-induced coating as an anodic film that makes magnesium alloys as non-corrosive and abrasion-resistant as aluminum alloys.

Magnesium alloys would be of particular value in the large aircraft projected for the future where a saving of several thousand pounds might conceivably be effected, since planes of exceptionally long range require as much as two pounds of gasoline for each pound of additional weight to maintain the range.

Magnesium weighs a third less than aluminum. Weight increase to 0.040 inch thick magnesium sheet treated on both sides is only eight-tenths of one per cent or one-seventh of the weight of a prime coat of paint and two coats of lacquer.

The film is described as extremely tight and very resistant to electrical current and abrasion. It readily withstands the potential of 110 volts which, together with its resistance to wear and impervious surface, accounts for its ability to retard corrosion.

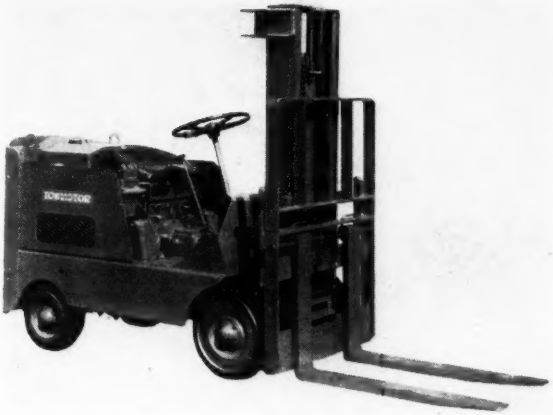
Convair engineers say that accelerated tests show magnesium alloys coated with the new finish holding up as well as and, in some cases, better than anodized duraluminum.

A postwar factor is the high degree of smoothness of the finish and the possibility that dyes can be introduced into the anodic solution with subsequent production of a wide variety of colors. Search for the coating was undertaken in 1941 in Convair's San Diego plant, but the satisfactory method was developed only recently at the company's Fort Worth, Texas, division.

Back Rest Extension for Towmotor Truck

To facilitate the handling of unusually high stacks of bags, drums, bales, boxes and other small bulky units, the

Towmotor Corp., 1226 E. 152nd St., Cleveland, Ohio, has developed an extension for the lifting carriage back rest of its standard lift truck. Of all-steel, all-welded construction, the extension can be quickly attached by inserting the permanently attached pins into sockets welded to the standard lifting carriage. Thus held firmly in position, the extension increases the support area afforded by the standard back rest of the lifting carriage and enables multi-unit loads of unusual height to be handled with normal stability and safety.



Towmotor Standard Lift Truck Equipped with Back Rest Extension

The extension shown in the accompanying illustration extends 60 in. above the surfaces of the lifting forks. Other models increasing carriage back rest height from 48 to 72 in. above forks are available to meet individual requirements.

Lenba-Solv

An odorless, harmless, non-toxic solvent which is said to produce no dangerous nor health hazardous vapors has been introduced by Lenba Products Corp., 408 Chanin Bldg., New York.

SOLVE YOUR SPEED-UP PROBLEM WITH A

Write for full information about this sensational new method of finishing or deburring delicate parts by tumbling.

LUPOMATIC TUMBLING MACHINE CO., INC.
4510 BULLARD AVE. BRONX, N. Y.

CUT DOWN REJECTS WITH

ORVUS

IN YOUR METAL CLEANING BATHS

This sulfated fatty alcohol Cleansing Agent is EFFECTIVE
—as a surface tension lowering agent
—as an emulsifier
—in dispersing lime soaps which might cause poor plating results if permitted to deposit on the metal

Write for further information about Orvus to

PROCTER & GAMBLE, Cincinnati, Ohio

N. Y., under the name "Lenba-Solv." It is water solvent and is a powerful synthetic emulsifier and penetrant. Lenba-Solv is neutral and stable, being neither acid nor alkaline. It has a flash point (open cup) in excess of 160 deg. F. and therefore can be used either hot or cold.

It is claimed that Lenba-Solv actually dissolves all types of soil, including oil and grease, buffing, cutting and lapping compounds, cutting and machining coolants, on either ferrous or non-ferrous metals by immersion and rinse. (Gentle agitation is recommended in some stubborn cases.)

The articles being cleaned may be rinsed either in water or in Lenba-Rinse, a companion product of Lenba-Solv. When the special rinse is used, a slight non-oily deposit is left from the Lenba-Rinse itself (not from the grease being removed) and paint can be applied over this deposit. It is claimed that it will also prevent the parts from rusting for considerable periods, as in the case of parts left on conveyors, put into bins for further fabrication, and so on.

"Sec-A-Sil"

A granular silica gel for use in packaging guns, engines, plane parts and machinery to prevent rusting and corrosion during shipment, to be known as

Illustration showing bags of "Sec-A-Sil" silica gel being tied to cylinder of aircraft engine

"Sec-A-Sil," has been developed by The Permutit Co., 330 W. 42nd St., New York 18, N. Y. The chemical is supplied packed in bags which are tied to the equipment to be packaged for shipment in a manner similar to that shown in the accompanying illustration. Parts thus arriving at their destination are ready for use without any operations other than the removal of the bags.

Sec-A-Sil protects metal parts by keeping the humidity of the entire package at such a point that corrosion cannot take place. According to the manufacturer, silica gel granules absorb half their weight of water by physical action and do not swell, dissolve or have any chemical reaction during the absorbing process.

Used in connection with Sec-A-Sil in each package of war material is a humidity indicator. This indicator is a card containing cobalt impregnated silica gel which changes color as the air within the package changes in humidity, thus enabling inspectors to tell when the silica gel has absorbed its capacity of the moisture in the package or if the moisture-proof wrapper is leaking. When the air is dry, the cobalt granules are a deep blue; however, as humidity in the package increases, the granules change to violet through pink to white.

Penetone

The Penetone Company, Tenafly, N. J., has introduced a degreasing and cleaning medium known as "Penetone" which contains neither carbon tetrachloride nor trichlorethylene, chemicals not now available except on W.P.B. allotment.

Besides its availability and efficiency, Penetone is said to offer other advantages. Chief of these is its complete safety both from fire hazards and injury to operators. It is claimed that Penetone contains nothing that is toxic, inflammable or injurious to the skin.

Penetone, as a degreaser for metals and machinery, comes in two formulas. The standard Penetone is said to be suitable for more than 80 per cent of all applications, including degreasing jobs where the lighter types of greases and oils are used, as well as general maintenance. "Penetone Senior," a stronger concentrate, is recommended for use on heavy oils and caked-on greases.

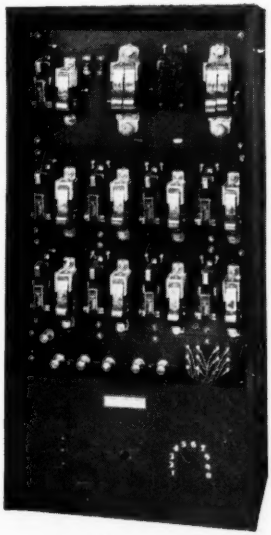
The formulation of Penetone is such that by rapid emulsification and the ability to decrease surface tension, oil, grease and the adhering dirt are quickly loosened and removed. It is recommended that small metal parts be placed in a bath consisting of a solution of one part of Penetone to ten parts of water. Either warm or cold solution may be used in the case of light-bodied oils. The heavier oils require a solution warmed to about 180 deg. F., while rinsing may

often be dispensed with. Penetone exerts a mild inhibiting action on the metal surfaces which, while not always suited for permanent needs, is sometimes useful while materials are in process to retard corrosive effects.

Another Penetone product known as "Major" is recommended by the manufacturer for heavy duty degreasing, requiring an extremely potent preparation. This concentrate is combined in the ratio of one to seven with kerosene for certain purposes, in the same ratio with water for other purposes, and again one part of the concentrate to seven of water and seven of kerosene for still other uses.

Zenith Magnetic Voltage Selector

A magnetic voltage selector manufactured by Zenith Electric Company, 152 W. Walton St., Chicago 10, Ill., is said

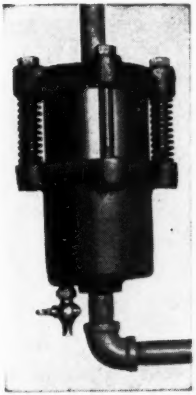


Zenith Magnetic Voltage Selector

to show advanced features for precision and efficiency. This unit, while especially developed for a new electroplating process for anodizing aluminum on alternating current, has many other uses where like applications of current are required.

The selector is designed for transfer-

DRY
COMPRESSED AIR



● Universal Air Filters have proven their superiority over many years' use on compressed air lines for removing condensed moisture, oil and other impurities.

The synthetic porous stone used as a filter medium (in addition to the well-known principle of centrifugal action) causes this filter to deliver pure, dry air for process use by the leading Industrials of the United States.

Two filter stones are furnished with each unit to assure continued operation during simple cleaning process. Maintenance is easy and inexpensive.

Write for detailed information and circular.

UNIVERSAL FILTER COMPANY

Manufacturers

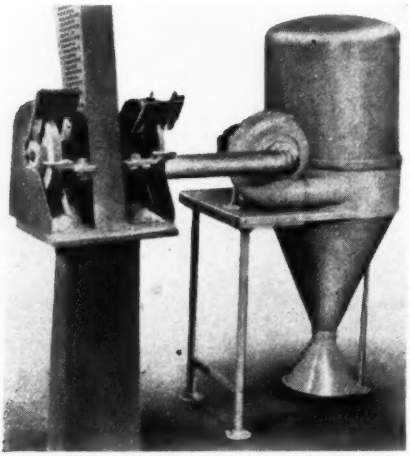
7025 Manchester Ave. • St. Louis, Mo.

ring in steps from 2 to 40. The arrangement is such that when transferring, the main contact opens before the secondary contact opens, and closes after the secondary contact is closed. Arcing is thus effectually eliminated.

The unit embodies automatic main magnetic contacts, and automatic main switch contacts for nine positions at 2½-volt intervals from 2 to 40 volts. The unit is conveniently paneled for ready accessibility and is compactly cased.

Leiman Portable Dust Collector

A portable type dust collector which is said not only to provide an unusually powerful air suction to draw the dust away from the point of origin, but for efficient dust separation as well is now



Leiman Portable Dust Collector connected to double-wheel grinder

being offered by Leiman Bros. Inc., 168 Christie St., Newark 5, N. J. The unit is designed to include ample space for expansion of the air inside the system to slow down the air current, thus allowing the dust particles to drop away into a compartment for disposal.

Reasonably compact to permit it to be easily moved from one location to another, the Leiman Dust Collector can be used with machines having one or two grinding wheels or buffs, and also with sawing machines, belt sanders and other machines. The unit requires no outside piping connections and can be readily set up where desired.

The Leiman Portable Dust Collector occupies a floor space of approximately 20 x 30 in. and is available in sizes ranging from ¼ horsepower.

Eye Safety

To assist in the current campaign against industrial eye accidents, American Optical Company announces that it is now making available to industry the following free AO safety promotion services:

1. Safety posters dramatizing the importance of wearing safety goggles on eye-hazardous jobs.
2. A miniature newspaper—The Safety Clipper—published periodically and containing material on eye safety designed for reproduction in employee magazines or newspapers.
3. Analyses of plant eye hazards, and recommendations by trained AO safety representatives for effective eye protection program.
4. A 16 mm. sound training film titled "Right on the Nose" which demonstrates the simplest, quickest methods of fitting non-prescription safety goggles so that workers can wear them in comfort. Also available is a booklet bearing the same title and providing in printed form the information contained in the film.

American Optical Company safety representatives will be glad to arrange for any of the above services; or write direct to American Optical Company, Southbridge, Massachusetts.

McGill Vaporproof Safety Guard

Said to eliminate the danger connected with handling electric lights in wet places, a vaporproof safety light bulb

For a real good polishing job use

KEYSTONE EMERY

TURKISH — NAXOS — AMERICAN

KEYSTONE EMERY MILLS *Write for Sample* 4316 Paul St., Phila., Pa.

guard designated as the No. 3007 has been announced by the McGill Mfg. Co., Valparaiso, Ind. Constructed of non-metallic materials so as to make it shockproof and non-sparking, the guard is light in weight, buoyant and will even float when placed in water.

McGill Vaporproof Safety Guard

According to the manufacturer, the splashing of liquids cannot cause breakage of the light bulb, since the bulb is covered by a heat and impact-resistant air-tight globe which is protected by a strong fiber cage. The cage itself is treated to prevent warpage and the whole is firmly attached to an unbreakable plastic handle that is fitted with a rubber bushing which, when squeezed in place by the screw nut at bottom, seals the inside airtight and keeps the wire in place.

The portable feature of the guard enables light to be taken where it is needed, even in hard-to-reach places. The guard, which is provided with a strong fiber swivel hook for convenient hanging, is recommended for use in shipyards, painting booths, around grinding and cutting machines, and so on.

Pennsalt Emulsion Cleaner Concentrate

Pennsalt EC No. 2, a concentrate-type emulsion cleaner comprising soaps, blending agents, and co-solvents for industrial grease cleaning applications, is soluble in water and in hydrocarbon solvents. It may be diluted with from 5 to 20 parts of suitable solvents such as low-cost kerosene, Stoddard solvent, or light fuel oil distillate.

Uses suggested by the Special Chemicals Division of Pennsylvania Salt Manufacturing Company, 1000 Widener Bldg., Philadelphia 7, Pa., the manufacturers, include as an emulsifying solvent in removing carbonized oils, grease, smut and drawing and buffing compositions. It finds use as a pre-cleaner, prior to electroplating, yielding a physically clean surface, and is also applicable to power washer and soak tank operations in water emulsion form or to increase the effectiveness of alkaline cleaners. The material also acts to inhibit rust formation. Packed in 55-gallon drums, Pennsalt Emulsion Cleaner Concentrate is available in commercial quantities.

SOL-KLEAN

for

Better Paint Adhesion

INDUSTRIAL CHEMICAL PRODUCTS CO.

DETROIT 7

Milwaukee **Fort Wayne**

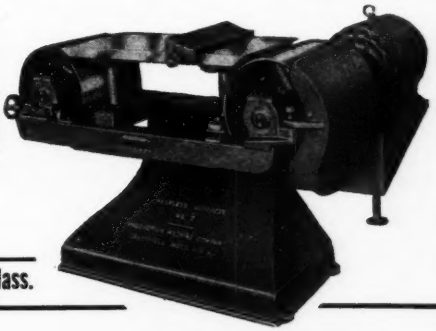
Speed & Quality

These machines employ abrasive belts as finishing members to produce fine quality in the grinding and sanding of flat surfaces. They can be used on metal, wood, hard rubber, celluloid and plastics. Furnished in 9", 14", and 20" sizes.

PEERLESS ABRASIVE SURFACER

Other types Vertical and Horizontal for flat or round work.

PRODUCTION MACHINE CO., Greenfield, Mass.



Model 7 "Eye Savers"

A rugged, all-plastic goggle for general industrial utility has been placed on the market by Watchemoket Optical Co., Inc., Providence 3, R. I. The one-piece lens is of shatterproof methacrylate that is said to withstand heavy impact, and is highly resistant to pitting caused by sparks. The curved plastic frame fits the face snugly but comfortably and shields the eyes from every angle, a very important feature.

Model 7 "Eye Savers"

The unique construction permits easy replacement of the low-cost lens. The Model 7 is sturdily made to give long, safe service and is reinforced with a high-brass clip at the bridge. The lens is non-fogging. Light weight makes the goggle ideal for women workers. Other styles are available for wear over prescription glasses.

Dravo Direct Fired Heaters. The Dravo Corporation is now offering Bulletin 509 entitled "Dravo Direct Fired Heaters." The bulletin, which contains 16 pages, deals chiefly with the economy of use and installation of these heaters and their flexibility of application. Diagrams showing nine basic designs and giving Btu capacities, dimensions and specifications for 44 models are shown. Write for Bulletin 509 on your firm letterhead to Dravo Corporation, 300 Penn Ave., Pittsburgh 22, Pennsylvania.

"Industrial Wire Cloth, Engineering Data and Price List," a technical reference book, is offered without obligation by the C. O. Jelliff Mfg. Corporation, Southport, Conn., to industrial users of wire mesh and cloth. This pocket-sized booklet, 96 pages, explains simplified ordering procedure facilitating shipments, explanations of different types of weaves in wire cloth, metals and alloys available, and laboratory and research facilities. Tabular material lists complete data on wire sizes, gauges, standard weights for each size of diameter for various metals and alloys, and methods of calculating weights of wire cloth.

"Save Solvent" is the heading of an 8 x 10-in. card which has been prepared especially to help all users of degreasing machines cut down solvent consumption to a minimum, in view of the present necessity of conserving all materials for the war effort. The card lists several

Color Matcher Wanted

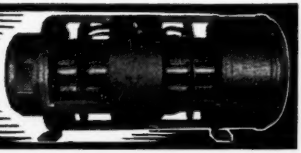
Location Chicago. Printing ink or paint experience required. Must be draft exempt. Address Box No. 35, PRODUCTS FINISHING, 431 Main St., Cincinnati 2, Ohio.

BETTER PLATING, LESS COST!

"MGC" ELECTROPLATING EQUIPMENT

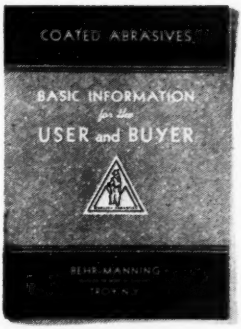
Write for Interesting Details TODAY!

MOTOR GENERATOR CORP., HOBART SQ. BOX N 34 TROY, OHIO



possible sources of waste of degreasing solvents. One or more of the cards for each of your degreasing machines will be supplied without charge on request to G. S. Blakeslee & Co., Cicero 50, Ill.

Coated Abrasives. This second Basic Information Booklet on coated abrasives follows closely on the heels of Booklet No. 1 for distributor salesmen, published by Behr-Manning Corporation, Troy, N. Y. So great was the demand for the distributor book that Behr-Manning felt



obliged to provide this revised edition for buyers and users of coated abrasives. The booklet is a down-to-earth discussion of coated abrasives, their component parts, their manufacture, and their ultimate use, including information on how to identify, how to order, and how to store sandpaper — 28 pages of well written, illustrated information. Copy of this Basic Information Booklet is available on request.

Industrial Washing and Drying Machines. The line of washing and drying equipment manufactured by Industrial Washing Machine Corporation, 290 Burnet St., New Brunswick, N. J., is described and illustrated in a 10-page catalog now being issued by this firm. Machines illustrated include conveyor type washing machines, cabinet type washing machines (Rotospray and Segmented types), monorail washing and drying units, rotary drum type machines, and vertical type washing machines; data is given on each of these units. Copy of the catalog free upon request.

Industrial Type Unit Dust Collector. Bulletin 910 describing construction and performance details on the Pangborn Industrial Type "CK" Unit Dust Collector has been issued by Pangborn Corporation, Hagerstown, Md. Features of the unit, together with the capacities and dimensions of the three sizes available, are completely covered in the bulletin. Of particular importance is the flexibility in arrangement permissible for adaptation to specific plant conditions. Copy of the bulletin may be obtained by addressing a request to Pangborn Corporation.

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FABRIC LINED
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In Cleveland it's the
HOTEL HOLLENDEN
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THE LANCASTER *Lancaster, Ohio*
THE BARON STEUBEN *Corning, N.Y.*

The Finishing Touch

J. A. Patterson

"They're my tires. They're gettin' so thin I thought a heavy coat of paint would give 'em a few more miles."